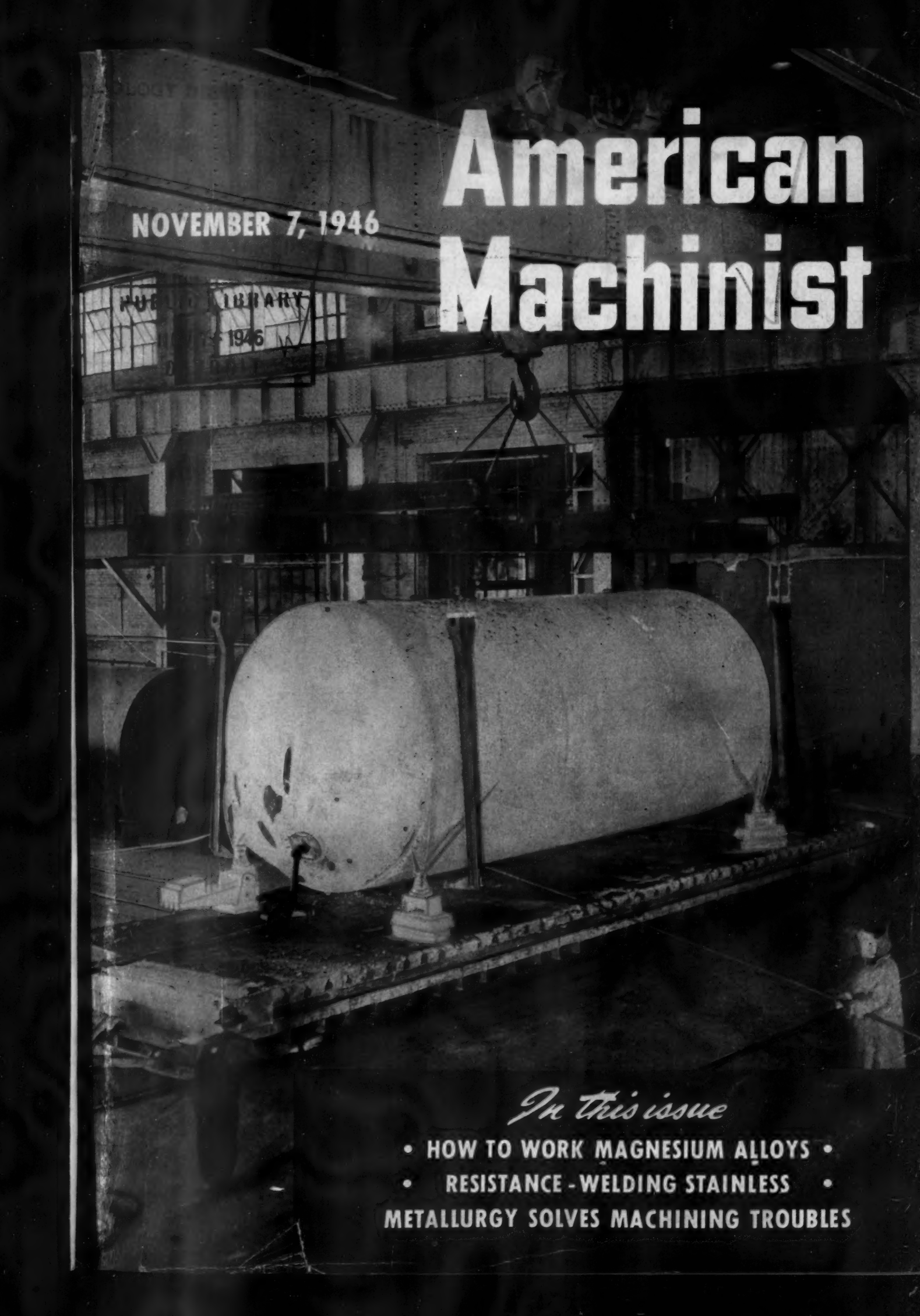
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• HOW TO WORK MAGNESIUM ALLOYS •
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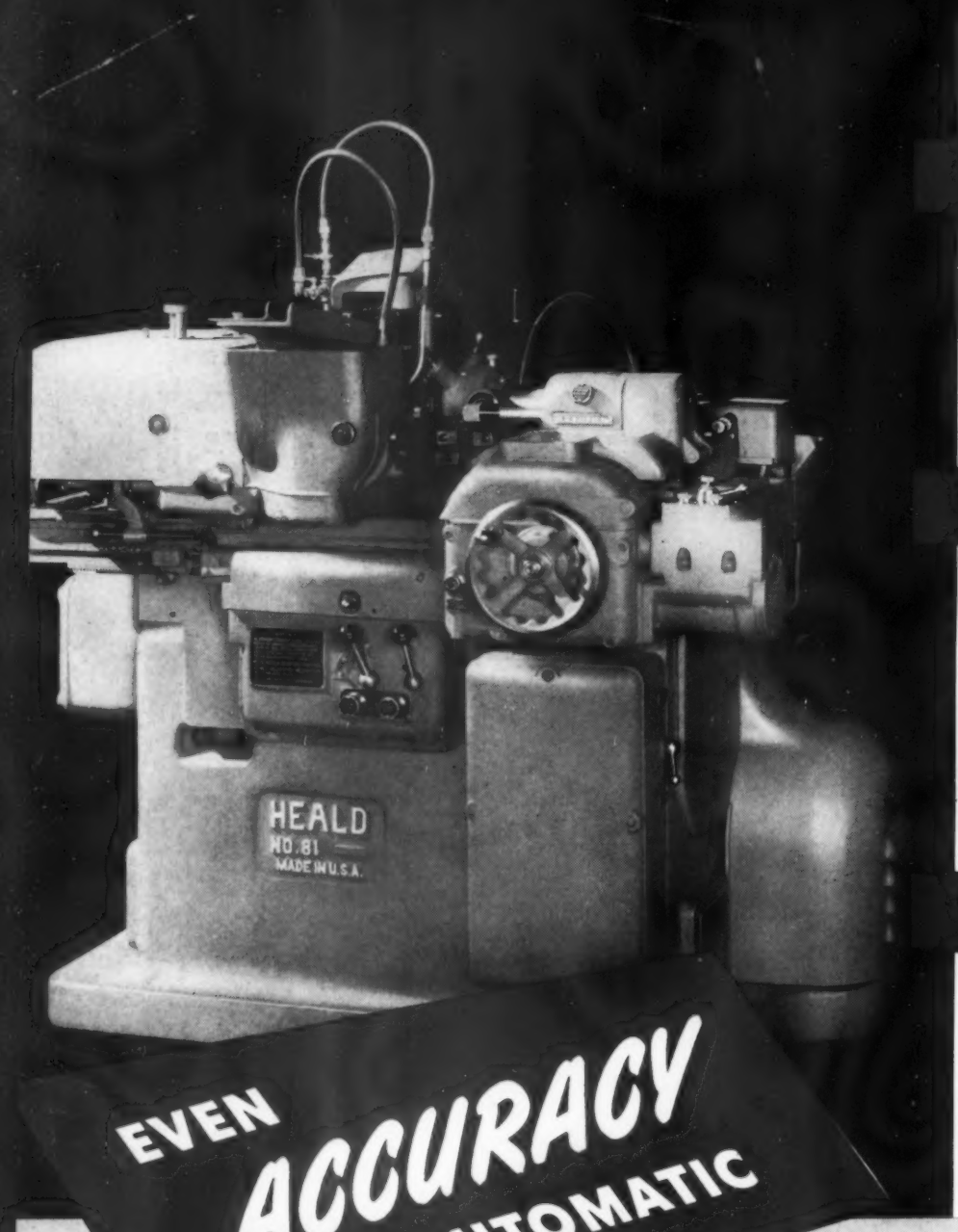
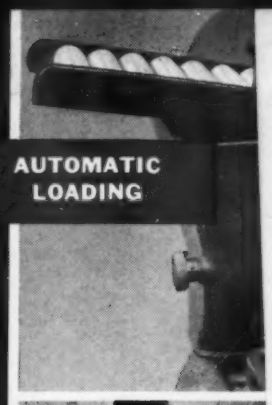
METALLURGY SOLVES MACHINING TROUBLES





EVEN ACCURACY IS AUTOMATIC

with the Heald No. 81 Centerless

JUST FILL the loading chute, and the Heald No. 81 Centerless does all the rest *automatically*—loading, rough and finish grinding, wheel truing, size-control, ejection—in one continuous cycle. That's why this Heald Centerless is the *only* completely automatic grinding machine. One operator—even an unskilled mechanic—can handle as many as six machines at one time . . . do it in faster preset cycles, under less strain and fatigue.

Accuracy, too, is automatic. Perfect concentricity is assured by a unique method of generating the bore from the outside diameter of the part itself. Instead of using a chuck, the work is held between three rolls in the Centerless workhead. And any type of hole can be sized to tolerances of tenths-of-thousandths—without extra gaging—by either Size-Matic or Gage-Matic controls.

Very likely you have a job that could be handled *automatica*
No. 81 Centerless — fo
tive, more economical
full information to: THI
COMPANY, Worcester 6

HEA

means ma

Tech.

INTERNAL AND SURFACE GRINDING MACHINES • BORE-M

ECHNOLOGY DEPT!

American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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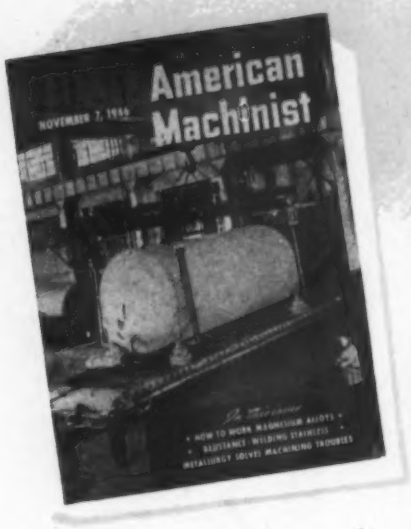
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Chips and QUIPS

Behemoth Beer Barrel . . . Red-hot, and just leaving the gas-fired annealing furnace at A. O. Smith, another beer tank to help quench America's thirst was Kodachromed by M. Hans Zielke to make our cover picture.

After arc-welding, the tank gets this 50-min. anneal to de-gasify the welds. It will be removed from the furnace carrier by the crane rig (here being attached by asbestos-clothed hookers) and cooled in air. Sandblasting will clean it and descale the surfaces so the slip (frit suspended in water and held together with clay) will grip firmly when sprayed on. Then it will be dried and popped back in the furnace where the slip will be converted into a glass lining while a stress-relieving takes place.

This tank, a bit over 12 ft. in diameter by 40 ft. long, weighs 33,000 lb. and will hold about 1,100 barrels of the stuff that is so hard to get these days. After we got our whiskers scorched firing a string of ten of the biggest flash bulbs so Zielke could get a split-second action shot of this light-and-generating brute, we joined his search for a foaming beaker of the ultimate product with a size 16 collar. And Milwaukee, the town that beer made famous, served us milk.

Very Special Report . . . Darkest secrets on fabricating our lightest metal are brought to light in the special report in this issue. Associate Editor Ashburn set a new high in travel budgets getting this lowdown from producers, fabricators and users. He shoehorned the facts, stripped for reading speed, into 16 pages you'll want within reach if you are working, or going to work, with magnesium alloys.

Metal Show in Print . . . Contents of this issue parallel specialties of production men interested in the Metal Show at Atlantic City in ten days. There's a bang-up story from Bendix showing how metallurgists and heat-treating are aspirin for machining headaches. They "start working the instant you take them," and aren't hard to take . . . There's a quick page of suggestions in ordering heat-treatment, too . . . We start a 3-article feedbox data series on resistance-welding stainless with an installment on spot-welding—based on Taylor-Winfield experience . . . Also about stainless is a down-to-earth batch of hints on tools for drawing it, from an expert on making them . . . There are details on another production tool, too—X-ray, as Westinghouse sees it.

Coming . . . Car-wheel maintenance has been mechanized by the B & O at Glenwood—see the 2-part story starting in Nov. 21 *A.M.* . . . Also an opinion on the problem of shop supervision, a prize group of miniature operations at Hamilton Watch (in picture-sketch-caption form), the facts on seam-welding stainless, Loeper and Hughes worth-listening-to ideas on palletizing, some new and useful information on mold steels and on apprentice training, a new development in measuring surface finish, and some suggestions on using gages . . . With usual departments, they make a meaty issue for a late-Fall evening's study by the fire . . . From what we hear, that may be the only meat you can get.

No Buck Missing . . . Those dratted puzzles (with no answers—even upside down) in Jones & Lamson ads suggested to us a test for our self-satisfied statistical division. We passed them the one about the vanishing dollar, which you puzzled over in *A.M.* for Aug. 15. With two calculators, an adding machine, a slide rule and log charts, they gave this answer: "The trouble is that somebody tried to add the wrong figure to the right one to get the wrong answer. Here's the right way: The hotel got $25 for the room, the bellhop kept $2, for a total of $27, and that's what the three men paid altogether. As far as the $30 figure is concerned, the return of $3 to the three men reduced their total outlay to $27."

Shucks, we got there first. We repeated the routine with pennies.

VIRUS VICTIM . . . Anderson Ashburn, our only red-headed associate editor, has a Michigan degree in mechanical engineering, and was editor of "The Technic," engineering monthly there, a job from an office he stumbled into by mistake. When various well-known editors called his the "finest undergraduate scientific magazine in America," he contracted the editorial virus.

After graduation, he spent a year and a half on the former "Tool Engineer," then came to A. M. A year or so and he went on to the Army, where he trained to become an automotive maintenance officer but was sidetracked into writing four Ordnance books, many speeches and reports, ending as usual with the title of chief editor—and captain's bars. Then we put him to producing the Shop Equipment News, Parts & Materials and the special report on magnesium alloys. For the record, he's a member of the Army Ordnance Assn. and the ASTE.

Tech

Why Use Coniflex Gears?

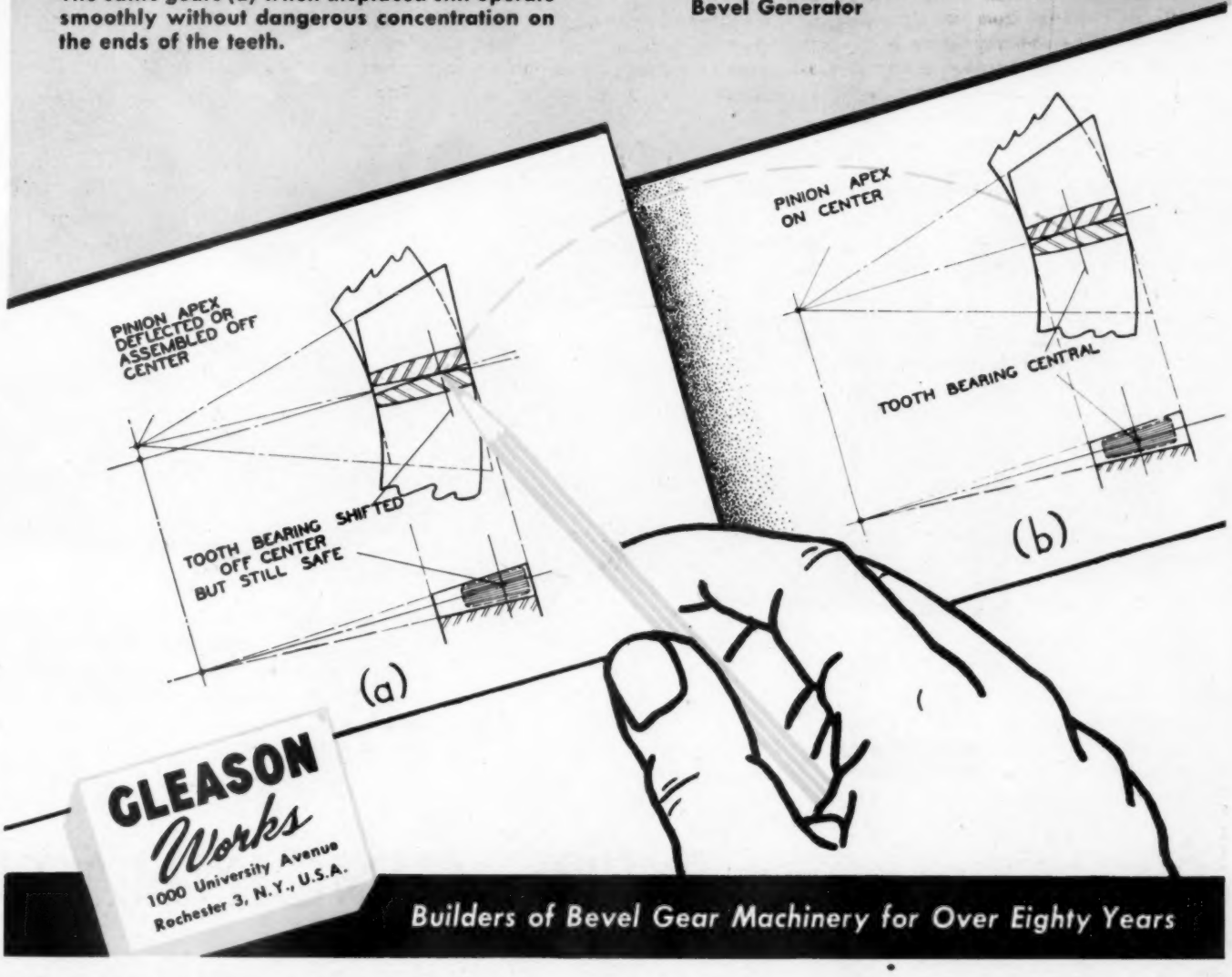
Coniflex gears are superior to ordinary straight bevels . . . they are the gears with localized tooth bearing . . . produced on the latest Gleason straight bevel generators in the medium and large sizes by means of a positive cam-controlled advance of the tool slides at each end of the cutting stroke.

Why are they preferred? . . . because the ends of the teeth are relieved, allowing for slight deflections in operation without dangerous concentration of the loads at the ends of the teeth. This also makes assembling simpler and provides a definite bearing for smoother, quieter operation.

The usual operating position (b) for generated straight bevel gears is with the bearing centrally located.

The same gears (a) when displaced still operate smoothly without dangerous concentration on the ends of the teeth.

Gleason 12" B Straight Bevel Generator


PINION APEX DEFLECTED OR ASSEMBLED OFF CENTER
TOOTH BEARING SHIFTED OFF CENTER BUT STILL SAFE
(a)
PINION APEX ON CENTER
TOOTH BEARING CENTRAL
(b)

GLEASON Works
1000 University Avenue
Rochester 3, N.Y., U.S.A.

Builders of Bevel Gear Machinery for Over Eighty Years

YOU CAN START WITH

CINCINNATI 16" Vertical Hydro-Tel Die-Sinker reproducing a single throw crankshaft die, using a metal master. Cuts may be taken longitudinally with the table feed or transversely with the cross slide feed when tracing from a master shape.

CINCINNATI

THE CINCINNATI

MILLING MACHINES

KINDS OF "MASTER"

on the CINCINNATI 16" Vertical Hydro-Tel Die-Sinker

Not choosy or the least bit "fussy" about the object to be traced, the CINCINNATI 16" Vertical Hydro-Tel Die-Sinking Machine will reproduce faithfully the die or mold impressions from any one of four basic types of traceable surfaces or objects.

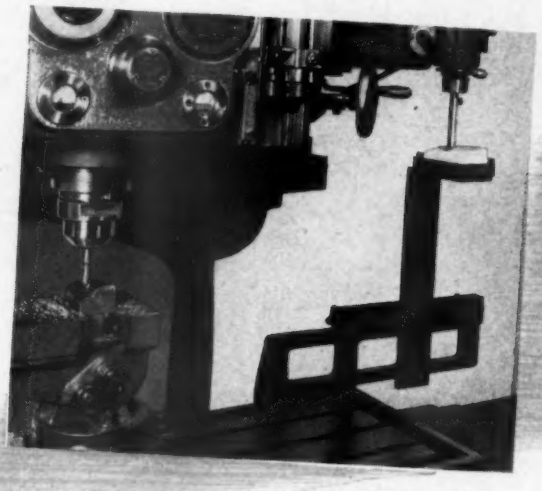
1—**Plaster or wood.** A humble beginning, but often a timesaver. The Hydro-Tel's extremely light contact pressure of the tracer finger makes this possible.

2—**Sheet metal templates.** Another low cost beginning, and extremely versatile, too, with Hydro-Tel's handy template support equipment.

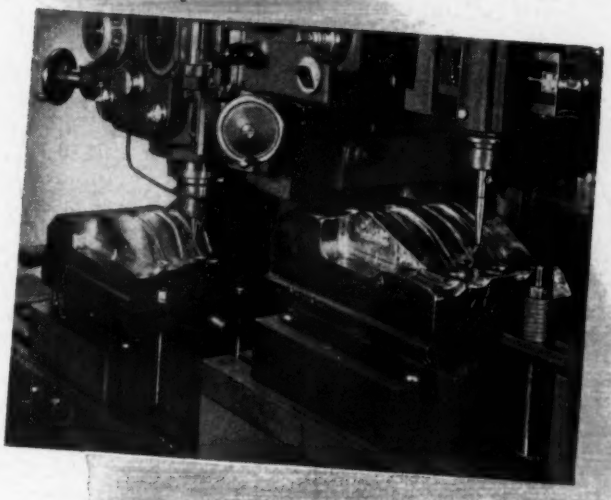
3—**Worn die block.** Simply clamp the worn die block to the master support bracket, and trace from it to make a new one.

4—**Master die block.** The elite of the traceable surfaces, employed principally when making a number of duplicate dies.

You will be interested in the host of features to be found on the CINCINNATI 16" Vertical Hydro-Tel Die-Sinker, and what they mean to you in producing low cost, accurate dies... in milling by power, shallow impressions and those up to 83° steepness of walls (standard 7° draft angle). All of these are illustrated and described in a new catalog just off the press—publication No. M-1497. Write for a copy.



1 Tracing a plaster clamping block insert. Tracer finger contact is so light it permits the use of wood, pattern compound, or plaster master shapes.



3 If, after long use, the die-block becomes worn, it may be employed as a master to reproduce itself in a new block.

2 An inexpensive way to mill die impressions is shown above. The cross slide (illustrated) and table are equipped with template support brackets.

MILLING MACHINE CO. CINCINNATI 9, OHIO, U. S. A.

BROACHING MACHINES • CUTTER SHARPENING MACHINES

No. 6. The Puzzle of the

Counterfeit Coin

Here are 9 coins and a scale. Eight of the coins are of equal weight — the ninth is counterfeit, weighs less.

The problem: What's the least number of weighings necessary to isolate the counterfeit coin?*

Tricky, this one, but very apropos. For it's quite a trick today to solve some metal turning problems . . . to remove metal more quickly, more economically, in the least number of operations.

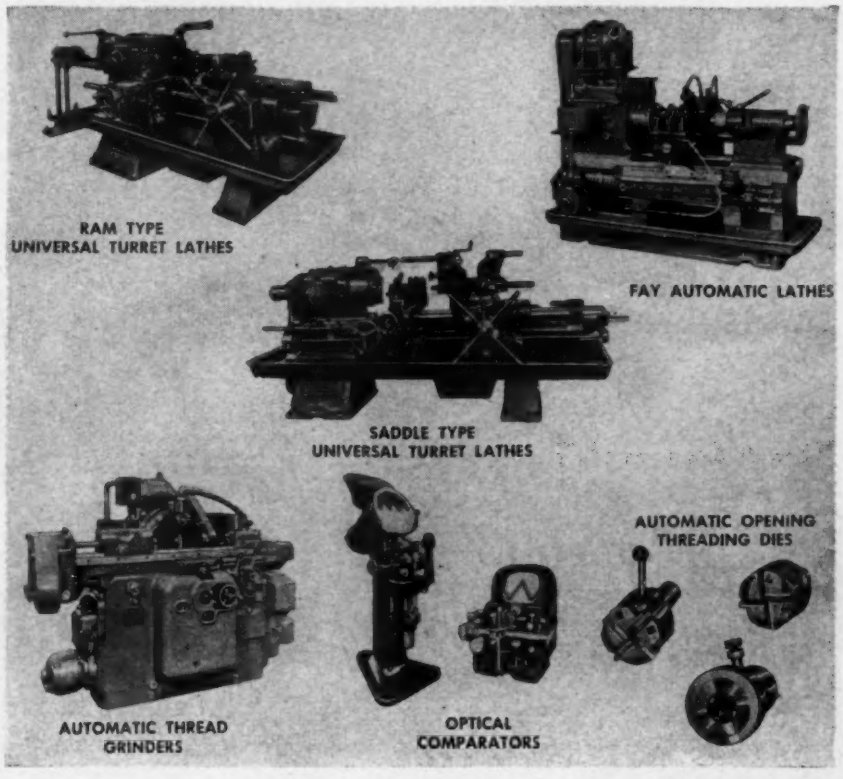
The chances are that turning accounts for 25 per cent or more of all machining time in your plant.

There are cases in our files of savings of hundreds of dollars a month in the manufacture of a single part by the use of Jones & Lamson machines. Our machines are designed specifically for the most efficient use of carbide tools which can remove metal 200 to 500 per cent faster. We have solved many tough cost problems. Solving them is our business.

Be skeptical of the production efficiency of all metal turning equipment in your plant.

Telephone or write for a Jones & Lamson engineer who will be glad to consult with you on all phases of your metal turning problems.

* The answer is 2.



JONES & LAMSON
MACHINE COMPANY
SPRINGFIELD, VERMONT, U. S. A.

Manufacturer of: Universal Turret Lathes • Fay Automatic Lathes • Automatic Double-End Milling and Centering Machines • Automatic Thread Grinders • Optical Comparators • Automatic Opening Threading Dies and Chasers • Ground Thread Flat Rolling Dies.

For Tooth Correction

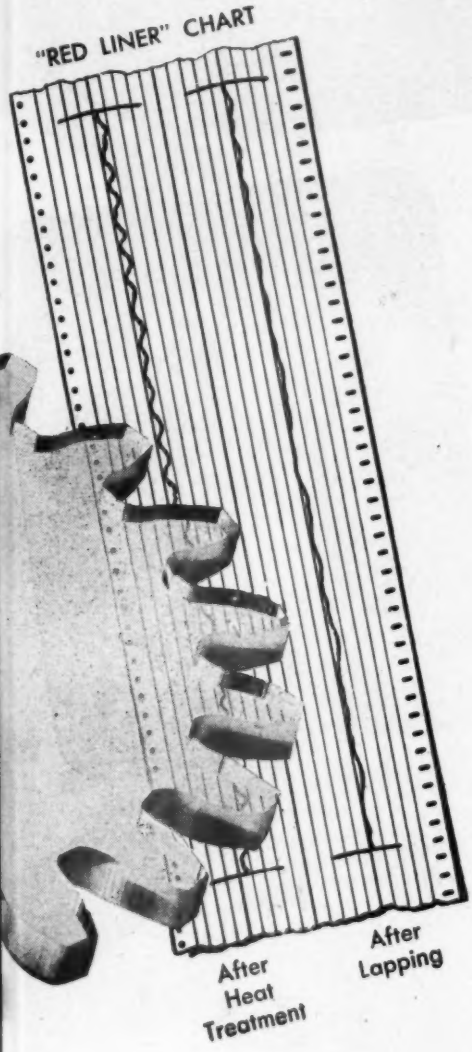
Fellows LS-Type Gear Lapping Machines handle external or internal spur and helical gears. Lapping time is automatically controlled assuring consistent and uniform results on a high production basis.

• **GOVERNMENT SURPLUS MACHINE TOOLS . . .** We are licensed under the WAR ASSETS ADMINISTRATION to act as dealers in the disposal of Government Surplus Machinery. Those interested in obtaining such machinery should contact our Main Office, Springfield, Vermont or our offices in Detroit, Mich. and Chicago, Ill.

THE FELLOWS METHOD . . . MACHINES AND TOOLS FOR

after Hardening...

Lapping!



The Fellows Method of gear lapping has proven both practical, and economical as a means for finishing hardened gears. War-time experience in the lapping of intricate gear shapes has demonstrated beyond all doubt the practicability of this method.

As indicated by this RED LINER chart minor tooth inaccuracies are removed by lapping. Careful attention to design and heat treatment, combined with lapping after hardening produces a superior product at lower costs than can be obtained by any other method.

Our engineers will be glad to place the company's experience at your disposal, if you are interested. For the ultimate in finely-finished accurate tooth surface Fellows Lapping is a notable advantage.

Write: The Fellows Gear Shaper Company, Springfield, Vermont—or 616 Fisher Bldg., Detroit—or 640 West Town Office Bldg., Chicago.

Fellows

FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

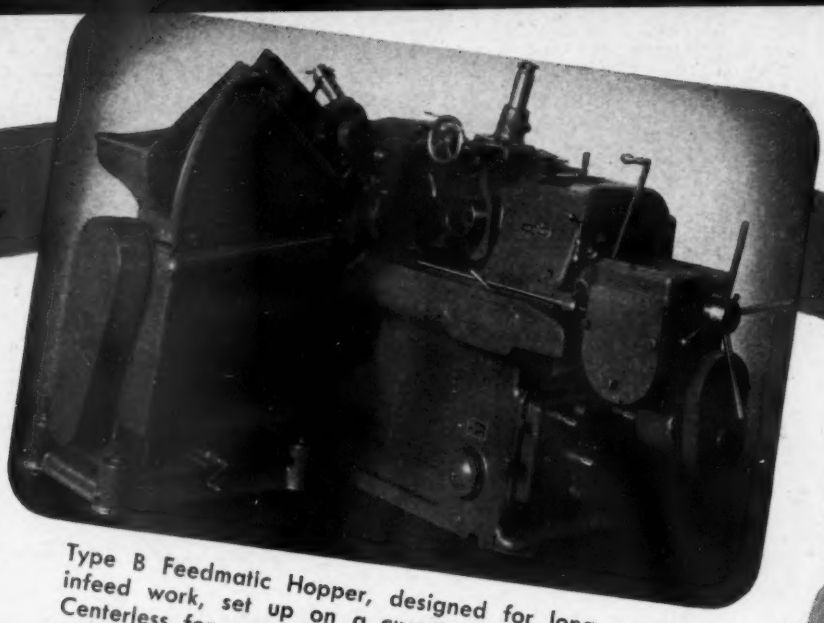
WITH THESE ATTACHMENTS YOU CAN ASSIGN MORE JOBS TO YOUR CINCINNATI CENTERLESS

● What kind of work do you want to assign to your CINCINNATI Centerless Grinder? Short, single diameter parts? Headed parts? Contour shapes? Steel bars? Small quantities or millions? Regardless of the shape, size, or quantity, the chances are that you can obtain a standard or semistandard CINCINNATI attachment designed especially for that type of work. And in special cases, Cincinnati Application Engineers (who have more than 20 years of centerless grinding experience at their disposal) will be glad to study your problem and recommend the most economical setup. Feel free to write to us, or get in touch with our nearest district office or agent. ¶In centerless grinding, it's CINCINNATI FILMATIC for the right size of machine and the right equipment for the job.

Type E Feedmatic Hopper for long runs of thrufeed jobs. Eliminates manual feeding operations. One man can operate several machines equipped with hoppers.

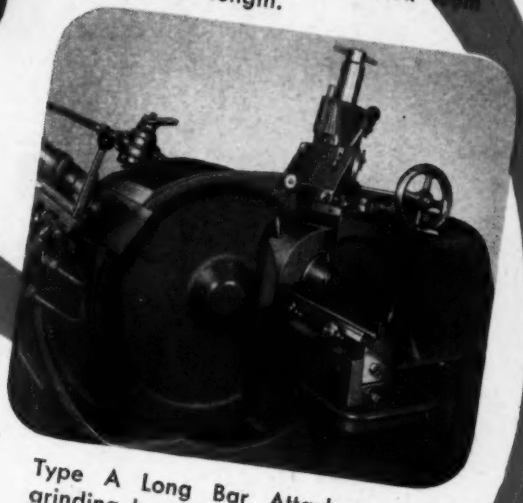
CINCINNATI

CENTER TYPE GRINDING MACHINES



Type B Feedmatic Hopper, designed for long runs of infeed work, set up on a CINCINNATI FILMATIC No. 2 Centerless for automatically infeed grinding connecting rod bolts. Shown at the right of the machine is the Automatic Infeed Attachment.

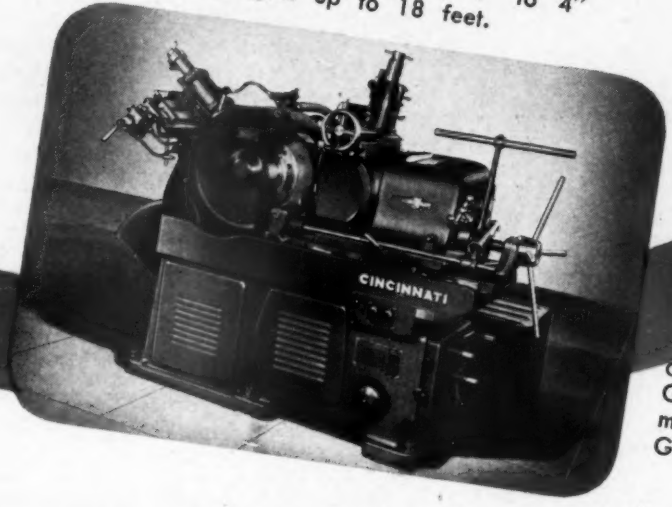
Roller Infeed Work Rest for supporting one end of the work while the other end is being ground. Made in several sizes to handle work from 25" to 55" length.



Type A Long Bar Attachment for grinding bars ⅛" to 1¼" in diameter and lengths up to 2½ feet.

Type C Long Bar Attachment for grinding bars ½" to 2" in diameter and lengths up to 18 feet. Type D Attachment also available, for CINCINNATI No. 3 Centerless Grinder only. Capacity 1" to 4" diameters, and lengths up to 18 feet.

Type B Long Bar Attachment for grinding bars ⅛" to 1¼" in diameter and lengths up to 8 feet.



CINCINNATI FILMATIC No. 2 Centerless Grinding Machine. Complete information is contained in catalog G-456-4.

GRINDERS INCORPORATED

CINCINNATI 9, OHIO, U. S. A.

CENTERLESS GRINDING MACHINES • CENTERLESS LAPPING MACHINES

Announcing...

...The NEW
VAN NORMAN No. 22M
Ram-Type Milling Machines

★

Featuring Greater Vertical Range

★ **ADJUSTABLE CUTTERHEAD PERMITS HORIZONTAL, VERTICAL, ANGULAR MILLING.**

★ **MOVABLE RAM PROVIDES MAXIMUM CAPACITY AND VERSATILITY.**

★ **FRONT AND REAR POWER CONTROLS FOR EASE OF OPERATION.**

The new Van Norman No. 22M is specifically designed for those applications where greater clearance between cutterhead and lowest position of table is desired. This feature is especially important in pattern shops, tool rooms, laboratories, die and mold shops where the greater vertical capacity permits milling on a wider range of work.

The Van Norman No. 22M provides the following outstanding construction advantages —

- Greater vertical range.
- Adjustable cutterhead permits conventional horizontal and vertical, as well as angular milling.
- New heavier cutterhead plus new spindle transmission provides greater load-carrying capacity.
- Aluminum alloy arbor supports provide easier handling.
- Hardened alloy steel gears mounted on hardened multi-splined shafts rotate on anti-friction bearings assure quiet operation and long life.
- Front and rear directional controls simplify operation, provide extreme convenience of control.

Investigate the new Van Norman No. 22M today. Find out how this outstanding machine increases production, cuts milling costs on a wide variety of applications. Available with plain or universal saddle.

VAN NORMAN COMPANY

SPRINGFIELD 7, MASSACHUSETTS

No. 22M with head in horizontal position. Table: 50 x 10 inches. Vertical range: 20".

"It pays to Van Normanize"

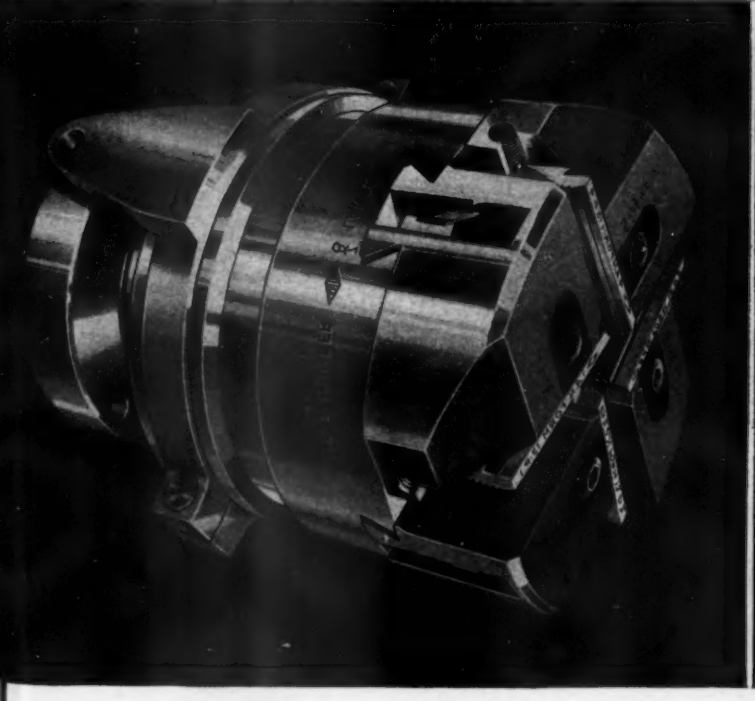
LANDIS

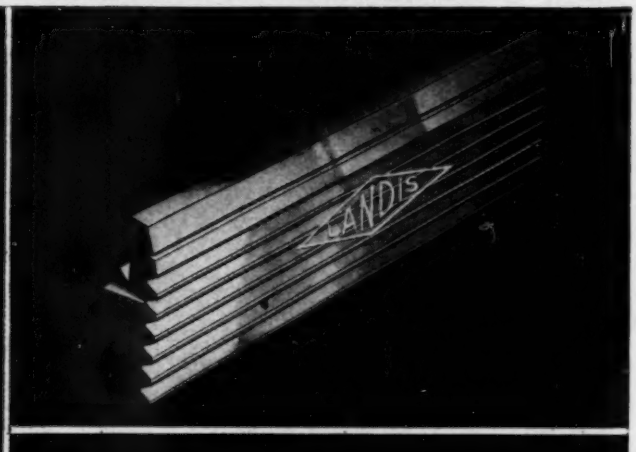
LANDIS THREADING MACHINES DIE HEADS AND CHASERS

Continuous operations, 24 hours a day, day in and day out, in hundreds of plants have proven Landis Threading Machines, Die Heads and Chasers to be time savers and cost savers. Landis Threading Equipment, because of ease of operation, finer accuracy and greater production at lower maintenance cost, will be an important factor in meeting your competition.

Write for Bulletin No. B-54

MACHINE CO. WAYNESBORO PENNA. U.S.A.





The illustration on the left-hand page shows a 7/8" single head Landis Threading Machine equipped with a 7V Lanco Hardened and Ground Head producing parts required in the manufacture of Fire Control Instruments.

THE LAST WORD IN CAP SCREWS

Positively prevents wasted time . . . each turn counts When the Knurled "Unbrako" Socket Head Cap Screw is used. The knurled head provides a fumble-proof grip even for oily fingers, and it can be screwed-in faster and farther before a wrench is used.

"Unbrako" and "Hallowell" products are sold entirely through distributors.

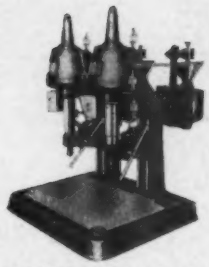
SIZES
No. 4 to 1½ diameter

The "Unbrako" Socket Set Screw with the Knurled Cup-Point is a Self-Locker, because the knurled point digs-in and refuses to budge . . . regardless of the most chattering vibration! Yet, this screw can easily be backed-out with a wrench and used again and again.

Pat'd. and Pats. Pending

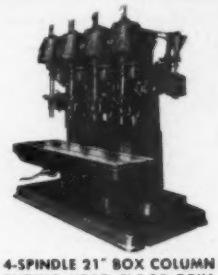
"HALLOWELL" KEY KITS . . . are modern MUSTS wherever socket screws are used. The hollow handle of Celanese* plastic contains the necessary interchangeable key-bits of superior alloy steel. Bits chucked as shown, when used. Their every-day and everywhere usefulness has made them immensely popular.

STANDARD PRESSED STEEL CO.
JENKINTOWN, PENNA., BOX 4 BRANCHES: BOSTON · DETROIT · INDIANAPOLIS · CHICAGO · ST. LOUIS · SAN FRANCISCO

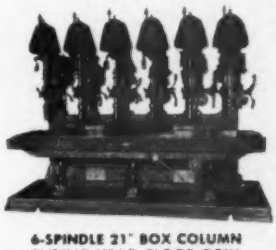


2-SPINDLE 16" NO. 5-10,000 B. V. BENCH DRILL

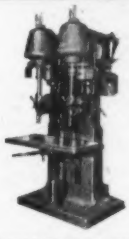
14" NO. 3000 F. V. SENSITIVE FLOOR DRILL



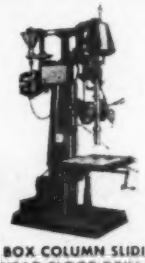
4-SPINDLE 21" BOX COLUMN SLIDING HEAD FLOOR DRILL



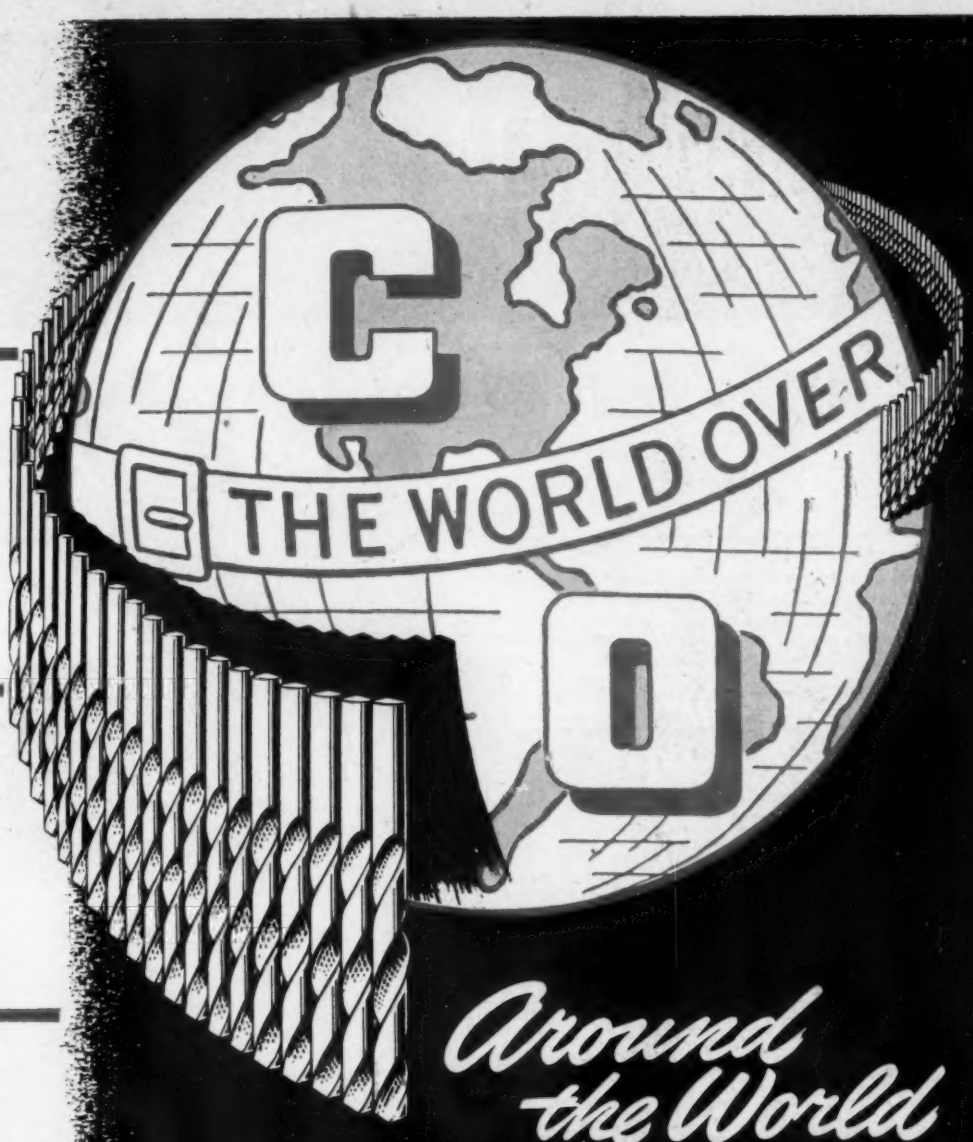
6-SPINDLE 21" BOX COLUMN SLIDING HEAD FLOOR DRILL



2-SPINDLE 21" BOX COLUMN SLIDING HEAD FLOOR DRILL



21" BOX COLUMN SLIDING HEAD FLOOR DRILL



Around the World

THE FINEST DRILL PRESSES MADE BEAR THE CANEDY-OTTO NAME

CANEDY-OTTO provides *the world's most complete drill press line* for you to choose from — each unit a product of 54 years experience manufacturing drill presses. You can buy *all* your standard drill presses from this one source, benefitting throughout your plant from the finer precision performance built into every CANEDY-OTTO Drill Press. Do not fill any drill press needs before reviewing the fully illustrated, detailed, CANEDY-OTTO catalog. Get your copy now.

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POWDERED METAL THREADING PROBLEM

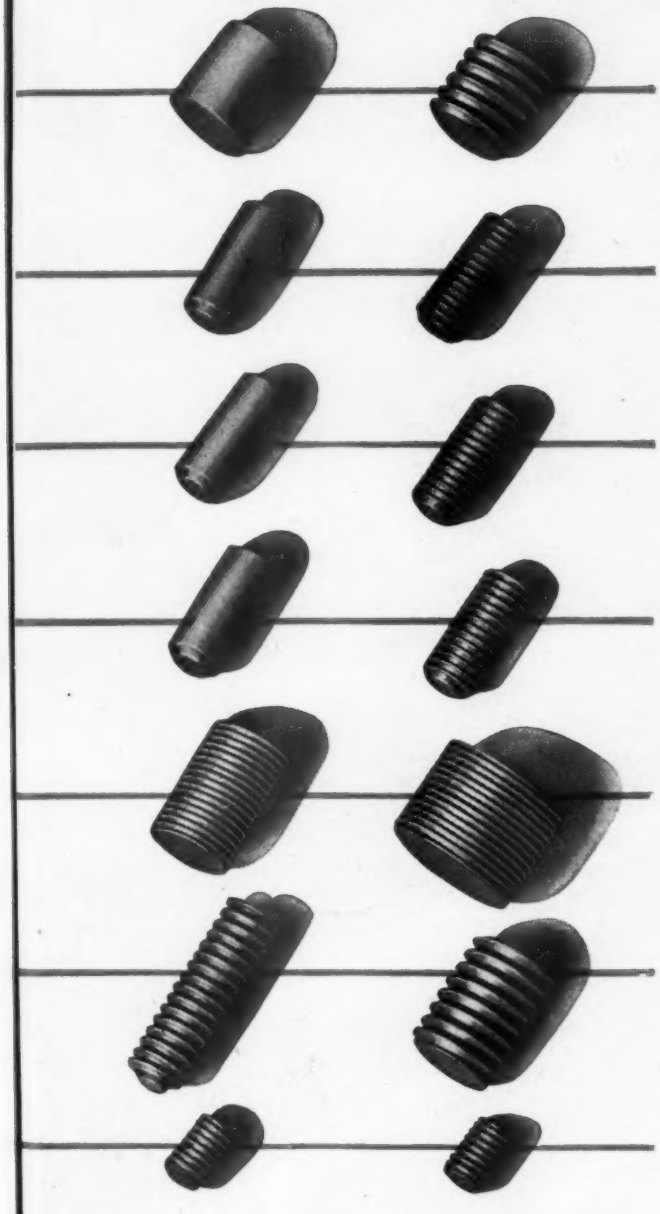
Centerless Thread Grinder—For grinding fine pitch threads from the solid in a single pass. High production to well within Class 3 fit. Separate built-in motor driven thread crusher and hydraulic wheel dresser give flexibility and minimum down time.

LANDIS TOOL
Precision Grinders

LANDIS TOOL COMPANY

SOLVED BY CENTERLESS THREAD GRINDER

SPOT CHECK REPLACES TWO 100% INSPECTIONS



Powdered metal blanks and threaded parts produced on Landis Tool Centerless Thread Grinder. Range of sizes illustrated #10-32, ¼"—28, ¼"—20" ⅜"—32, ⅜"—16, ⅝"—32.

Manufacturers of powdered metal parts had a production threading problem. Large production was needed with uniform electrical characteristics and good thread form.

Previous production methods caused crumbling of the metal and frequently produced changes in the electrical characteristics. This required two inspections—one for thread form and one for electrical characteristics—both 100%. The result, with rejections running high, was high cost production.

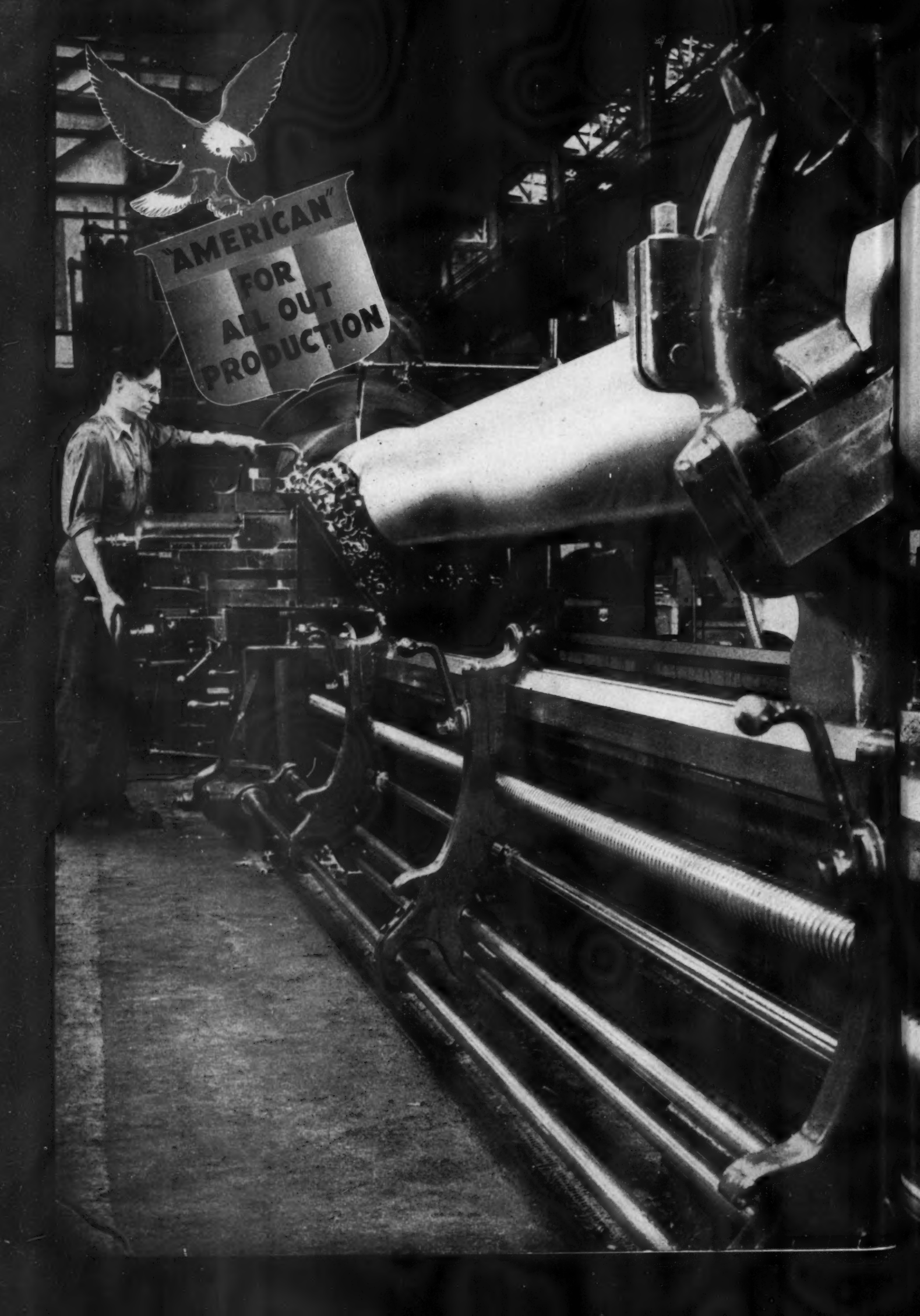
With the Landis Tool Centerless Thread Grinder only spot checking is necessary for thread form. Rejects have been practically eliminated and the multiple groove grinding wheel has practically unlimited life for long production runs. On one production run over 600,000 screws #10—32 x ¼ were ground from powdered metal blanks at the rate of 120-130 per minute and the thread form in the wheel still did not require recrushing.

Electrical inspection was eliminated by centerless thread grinding, thereby saving inspection time and rejects. After finished screws on an initial setup are found to meet the required electrical characteristics, all others meet the same standards.

Landis Tool Centerless Thread Grinders can meet a wide variety of thread grinding problems—high production, true thread form, accurate fits, fine finish. Write for descriptive bulletin or send details of your thread grinding problem for a recommendation. 45

WAYNESBORO, PA.

LANDIS TOOL Company


"AMERICAN"
FOR
ALL OUT
PRODUCTION

VISUAL PROOF

These tough jobs emphasize the superiority of "AMERICAN" Super-Productive Lathes.

They also turn the spotlight upon the necessity for HARDENED ALLOY STEEL INTERNAL FACE PLATE RING GEARS—ADEQUATE SPINDLE AND SHAFT BEARINGS TO ABSORB THE ENORMOUS BEARING LOADS AND PARTICULARLY UPON THE NECESSITY FOR POWER, STABILITY AND OVER-ALL RUGGEDNESS.

"AMERICAN" Super-Productive Lathes provide these essentials.

Bulletin No. 87 gives all the facts.

THE AMERICAN TOOL WORKS COMPANY

Lathes and Radial Drills

CINCINNATI, OHIO, U. S. A.

32 Alundum Grinding Wheels are *Sharper!*

BY a patented Norton electric furnace process the grains of 32 ALUNDUM abrasive form as single, complete crystals — each one with a nubbly surface and many sharp points.

And no crushing to size is necessary — an operation which ordinarily results in many grains with flat sides. When crushed grains are bonded into a wheel it is often the flat side that is exposed in the surface instead of a useful cutting point. But not so with "32". The uncrushed grains are pointed on *all* sides — no matter how they are bonded into a wheel, one or more cutting points are exposed.

You can feel the difference yourself. Run your finger along the edge of a 32 ALUNDUM wheel and any other aluminum oxide wheel of similar specifications. You can see why "32" wheels cut faster and cooler. And because there are more cutting points doing the work, fewer dressings are necessary and wheel life is longer.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

NORTON ABRASIVES

Trade mark reg. U. S. Pat. Off.

Ask your Norton abrasive engineer to give you a Vectograph demonstration of 32 ALUNDUM abrasive.

W-1077A

TOOL GRINDING

"Fastest and coolest cutting wheel we ever had."

That is what the tool room man of a large plant said after trying a 32 ALUNDUM wheel. They had always found a certain 46 grit, K grade wheel best for cutters, reamers and end mills. But by changing to a 32A54-K5VBE they found that stock was removed faster with a much improved finish. The "32" wheel also held corner better and cut cooler, leaving the tools a nice, bright finish.

TOOL GRINDING

Six times around a 10" cutter without dressing.

A high speed steel 10" diameter milling cutter with 18 inserted teeth each 3/8" x 1 5/8" was ground with a standard 46 grit, K grade wheel taking off .002" each pass for two revolutions. On the second revolution the last two or three teeth were burned a bright blue. On the third revolution, also taking off .002" all the teeth blued and the wheel showed a distinct glaze of steel.

With a 32 ALUNDUM wheel of the same grain and grade (32A46-K5VBE) .002" was removed from the teeth for each of six revolutions of the cutter. There was no burn and no wheel loading.

Almost Unbelievable

ARE MANY OF THE REPORTS THAT ARE COMING IN ABOUT

32 Alundum

INTERNAL GRINDING

Hole taper eliminated — wheel life tripled.

A maker of rayon pumps is grinding holes in a part made of high carbon, high chrome steel (SAE 51335 — Rockwell C56-57) removing .012" from each hole. They had tried many makes of wheels and the best life was an average of 10 holes per wheel. They changed to 32 ALUNDUM wheels (3/8 x 3/8 x 1/8"— 32A801-N8VBE) and life jumped to an average of 30 holes per wheel. They say, "The 32 ALUNDUM wheel breaks down only .002" per hole. Not only is this less than anything we have used before but the wheels remain true so that we can get a straight hole without any taper."

SURFACE GRINDING

Difficult job done in half the time with better finish.

A machine tool maker was having a difficult time grinding flat a cast iron core plate (35% steel scrap) because the many grooves and holes in it caused a rapid dulling action of the wheel. Changing to a 32 ALUNDUM wheel (32A36-G12VBEP — 20 x 6 x 10") solved the problem. It easily removes .020 — .030" of stock between dressings compared to .010" for previous wheel. The "32" wheel can feed .002" per pass as against .001" and requires much less sparking-out time. Grinding time for both sides of the core plate went from 35 to 40 minutes down to 20 minutes. Finish was better than any obtainable before.

PORTABLE GRINDER

Wheel cost cut 60%

For grinding welds and steel castings with a portable grinder, a manufacturer changed to a 32 ALUNDUM cup wheel (32A161-R4B5). Wheel life was increased three times with good cut and finish. Wheel cost per day dropped from $3.38 to $1.29.

"Brother, they're TOPS in To

for Non Ferrous Metals!"

MORSE SPIRAL FLUTED TAPS

are Specially Designed to Produce Clean, Accurate Threads in Aluminum, Magnesium, Zinc, Copper, Brass, and Stringy Metals

Conventional taps are ineffectual in die cast metals and metals of a stringy nature because they leave torn, rough, and damaged threads. *That's why Morse designed its Spiral Fluted Tap.* This tap is made specifically to produce sharp, clean threads in aluminum, magnesium, copper, brass, zinc, etc. . . . threads which have *lasting strength* and permanent *holding power.*

The Morse Spiral Fluted Tap is *free cutting* and, as it works into the metal, it automatically clears the chips from the hole, thereby eliminating clogged grooves.

Remember that, besides Special Purpose Taps, the wide Morse Line can provide you with a tap, standard or special, to suit precisely, for maximum effectiveness, whatever metal your production specifications call for — from magnesium to stainless steel. Morse engineers and your Morse distributor are ready to help you choose the *right* tap for *your* job.

Accuracy, Quality, Uniformity: the MORSE Code of Cutting-Tool Manufacture

MORSE TWIST DRILL & MACHINE COMPANY

The Original Manufacturer of Twist Drills

NEW BEDFORD, MASSACHUSETTS

NEW YORK STORE: 130 LAFAYETTE ST. • CHICAGO STORE: 570 WEST RANDOLPH ST. • SAN FRANCISCO STORE: 1180 FOLSOM ST.

CINCINNATI

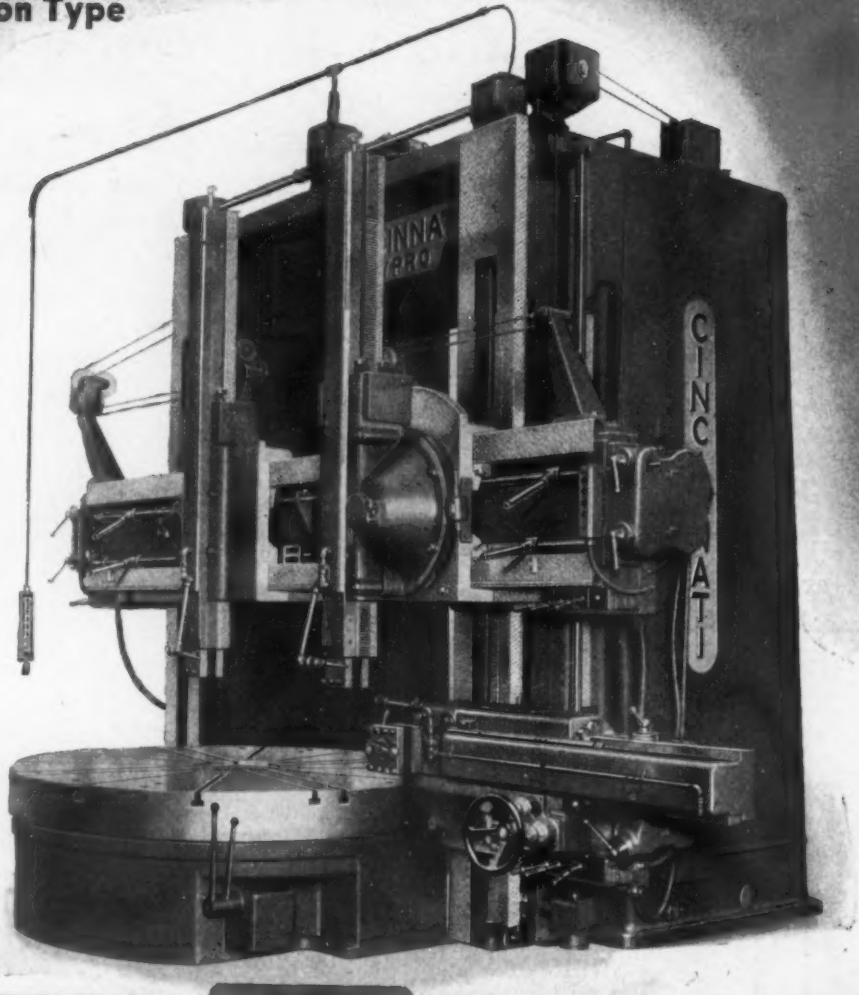
HYPRO

8-FT. HYPRO VERTICAL BORING MILL

Manufactured in all sizes from 54" to 12', inclusive

Also 12-16' Extension Type

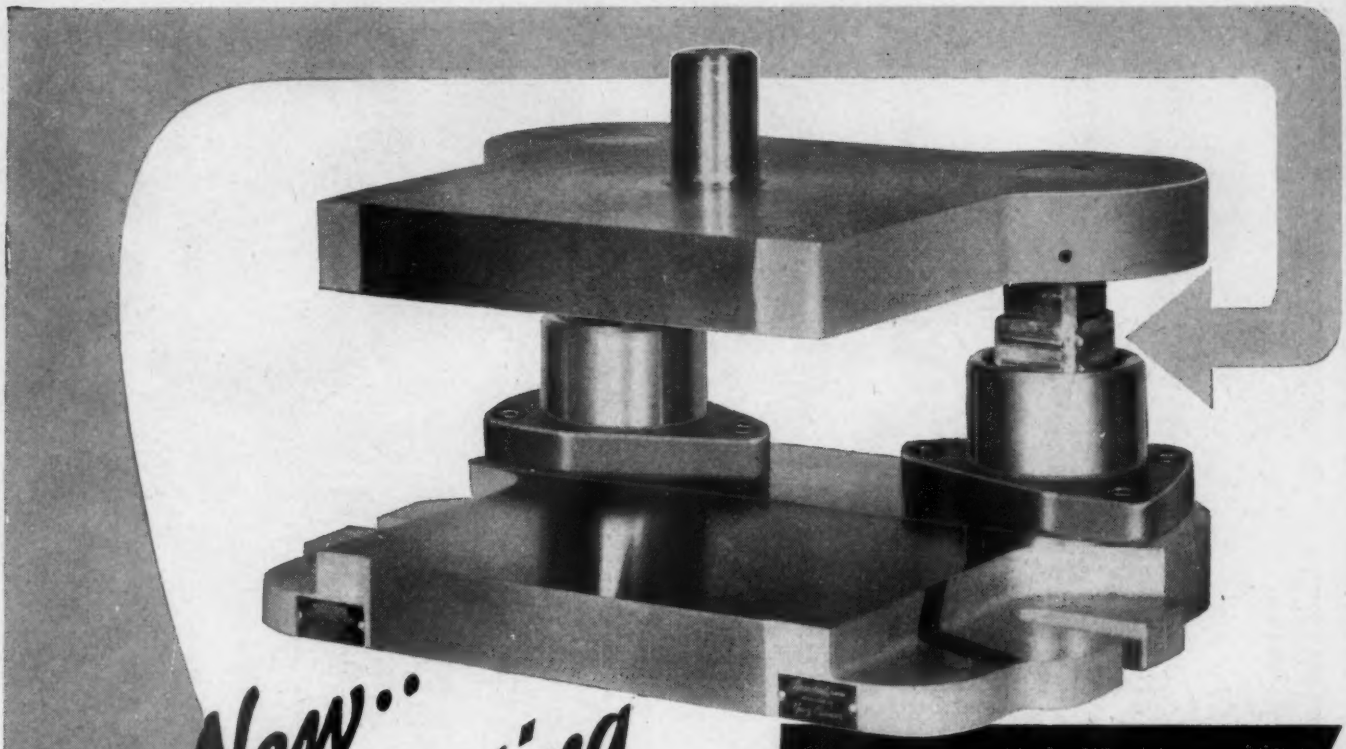
All Cincinnati Hypro Vertical Boring Mills are furnished with many exclusive Hypro-Duction features providing the maximum in accuracy, ease of control, rigidity and a wide range of feeds and speeds to cover the use of all classes of cutting tools on any type of material. Other exclusive features include complete individual feed and rapid traverse and reversing mechanism for each head. One-piece bed and speed box construction, anti-friction bearing mounted table, all transmission gears made of heat-treated alloy steel forgings. Anti-friction bearings provided for all shafts.



THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO



It's New.. Free-Operating ...Accurate!

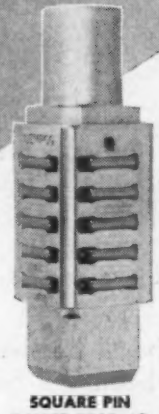
IT'S A LEMPCO PRECISION ANTI-FRICTION DIE SET

FOR increased die life . . . faster production . . . greater economy . . . put Lempco Anti-Friction Die Sets to work for you.

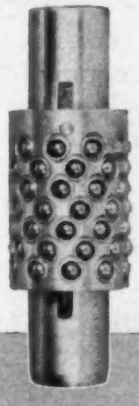
Lempco Die Sets are equipped with ball or roller bearing guide pins. As a result, dies can be set up by hand without the use of hammers, mauls, jacks or pry bars. This eliminates production delays caused by accidents to dies and punches . . . saves up to 60% of die setter's time . . . means extra profit for you.

Lempco Anti-Friction Die Sets have been run over long periods on a special press at speeds of *2000 strokes per minute.* To assure positive accuracy, bearings have pre-load of .0015". All surfaces including extremely long bosses are ground to exceptionally close tolerance.

Place your order today and make sure you cash in on all the money-saving features offered by Lempco Precision Anti-Friction Die Sets.



SQUARE PIN ROLLER BEARING



ROUND PIN BALL BEARING

LEMPCO

5711 DUNHAM ROAD
BEDFORD, OHIO, U.S.A.

● *Write for "Facts About Lempco Precison Anti-Friction Die Sets." It's a fully illustrated catalog which lists all the advantages Lempco Die Sets have for you.*

PAST PERFORMANCE

...a safe guide for "The Tools You Buy Again"

UNION TWIST DRILL CO.
Athol, Mass.

STORES New York Store: 61 Reade St.; Los Angeles Store: 524 East Fourth St.; Chicago Store: 11 So. Clinton St.; Seattle Store: 568 First Ave., So.; San Francisco Store: 121 Second St.; Detroit Store: 5527 Woodward Ave.

MANUFACTURING DIVISIONS

S. W. Card Mfg. Co., Div.; Mansfield, Mass.
Butterfield Division, Derby Line, Vt., and Rock Island, Quebec

Actual results — in terms of better, faster, more economical work—make standardization on UNION TOOLS a logical procedure and a sound policy. Years of specialization in development and manufacture has enabled UNION to produce long-lived, dependable small tools — tools that help keep production moving at maximum speed and accuracy at a minimum of expense.

Once you've put UNION tools to work, they'll be the "Tools You Buy Again." Performance will have been the basis for your choice.

THE UNION LINE

Twist Drills — Milling Cutters — End Mills — Taps — Dies — Screw Reamers — Hobs — Slitting Saws — Plates—Profile Cutters.

UNION

BITS

FOR DRIVING ALL THESE SCREWS

Handle is molded of sturdy Celanese* plastic; tools are of high grade alloy steel.

Contained in this Handle

HALLOWELL

"SOCKET SCREW" KIT

with interchangeable bits

For men who like to have a complete supply of tools, yet dislike bulk and confusion, the Hallowell "Socket Screw" Kit is the answer. It is one of the neatest tricks of the year. The hollow Celanese* plastic handle holds interchangeable bits for most all purposes . . . Phillips, Hex and Flat. There is a swivel bit-chuck, which locks securely in position, and makes it possible to twirl a screw using the vertical position, and then snapping the chuck to an angle or ell position, to get the final tightening pull.

Not illustrated: "Socket Wrench" Kit; the "Auto" Kit; the "Home" Kit. Write for our 8-page booklet that fully describes these handy Tool Kits. Obtainable at Suppliers throughout the country.

If your Supplier does not carry these Kits, send his name to us, along with yours, and you will be taken care of promptly.

Kits: Patents Pending

OVER 43 YEARS IN BUSINESS

*Reg. U. S. Pat. Off.

STANDARD PRESSED STEEL CO.

JENKINTOWN, PENNA., BOX 4 • BRANCHES: BOSTON • CHICAGO • DETROIT • INDIANAPOLIS • ST. LOUIS • SAN FRANCISCO

12-STATION SNYDER SPECIAL Mills, Saws, Drills, Counterbores, Reams, Burrs and Taps Auto Connecting Rods

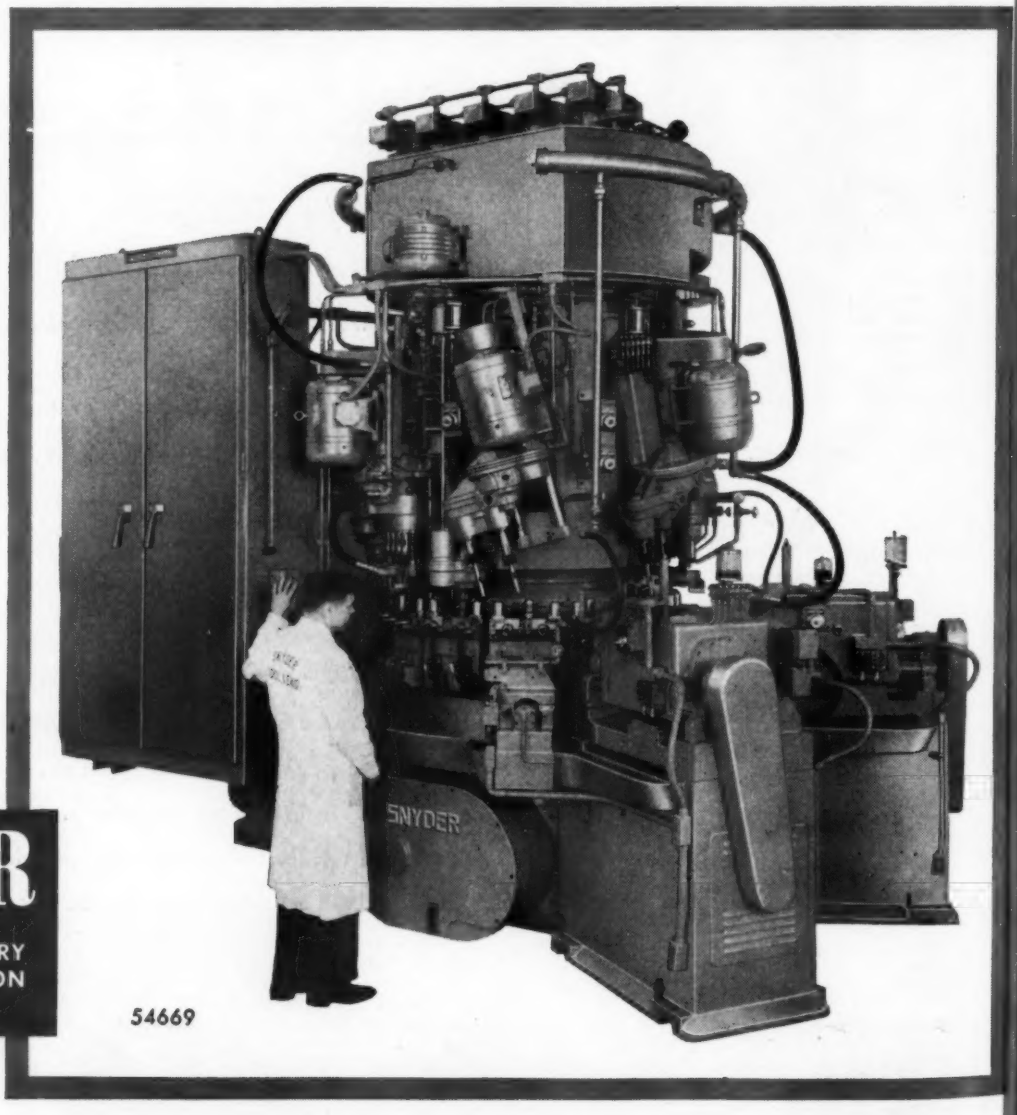
This special automatic was designed and built by Snyder for mass-production machining of drop-forged steel connecting rods. Operating at 80% of rated efficiency, the 12-station special delivers an hourly production of 266 connecting rods machined complete except for bearing cap joint faces and crank and wrist pin holes.

At the twelve vertical and horizontal stations, a total of sixteen operations is performed, including drilling, milling, sawing, burring, counterboring, countersinking, tapping and reaming. Parts are loaded two at a time and are clamped in fixtures by a power-driven wrench, then positioned for machining by the power-driven Geneva index table. The entire operating cycle is automatic.

Tool set-up and maintenance is simple and rapid. High speed steel tools employed throughout are provided with arbors and quick-change adjustable tool holders. Individual unit cycle control buttons permit positioning and adjustment. Rigid column construction, correct tool feeds and speeds, and proper coolant supply extend tool life and assure work of specified precision and finish.

Standard and special machining units have individual motors and drive through a change-gear box and V-belts. They are fed hydraulically except tapping head, which is moved to and from the tapping position hydraulically, but is lead-screw fed for work stroke. Base and column are constructed of fine-grained cast iron, thoroughly normalized and ribbed for strength and rigidity. Units are easily accessible for greasing and oiling.

Some phase of your production process may be similarly improved and speeded by the application of special machinery. Check with us for possible economies. *Snyder Tool and Engineering Company, 3400 E. Lafayette, Detroit 7, Michigan.*



21 Years of Successful Cooperation with Leading American Industries

SNYDER
DESIGNERS AND BUILDERS OF MACHINERY FOR HIGH PRODUCTION AT LOW UNIT COST

The CONE AUTOMATIC MACHINE COMPANY sees many GOOD THINGS AHEAD

It is reported that . . . . . .

Amplex Division of Chrysler Corp. proposes an industry-wide study to standardize bearing sizes.

get ready with CONE for tomorrow

Dow Corning Corporation has a new white enamel made of silicone resins that approaches baked enamel in its resistance to heat.

get ready with CONE for tomorrow

Bell Telephone Laboratory engineers have demonstrated a "tone synthesizer" that can imitate the sound of any musical instrument.

get ready with CONE for tomorrow

Raytheon Mfg. Co. has a compact, rugged radar set for installation on merchant vessels.

get ready with CONE for tomorrow

An instrument called a "metal Sorter", made by Control Equipment Co. of Pittsburgh, identifies unknown metals by measuring the electricity they develop when rubbed by a known sample.

get ready with CONE for tomorrow

"Liquid Honing", a method of finishing metal surfaces with a spray of emulsion containing an abrasive as fine as 2,500 mesh, is being promoted by Vapor Blast Mfg. Co. of Milwaukee.

get ready with CONE for tomorrow

American Steel and Wire Co. has a nail that can be driven into steel with a hammer.

get ready with CONE for tomorrow

Plastics can now be dip-dyed at room temperature with solutions perfected by International Printing Ink. The color becomes integral, and the physical properties of the plastic are not changed.

get ready with CONE for tomorrow

Oil Well Chemical Service Company of Fort Worth has succeeded, with the help of Monsanto, in sealing oil wells as deep as 11,500 feet with a liquid resin that permeates rock and holds back unwanted natural gas.

A new combination tapping and threading attachment is now available for a leading line of six spindle automatics. The unit has a wide, selective, threading range; it can be mounted in any one or a number of endworking positions, as required, and it can be readily installed or changed over. A descriptive booklet is available.

get ready with CONE for tomorrow

Gulf Oil has an additive said to prevent foaming in lubricating oils.

get ready with CONE for tomorrow

University of California scientists have produced a standard for the measurement of length ten times as accurate as the cadmium light ray now accepted by using a light wave from transmuted mercury (made from gold) excited by a high frequency radio beam.

The Army and Navy are studying our natural caves, such as Carlsbad and Mammoth, in order to determine their usefulness as war-time shelters for industry.

get ready with CONE for tomorrow

Union Oil Co. has "Uniperox", a peroxide made from petroleum for use as a jet plane fuel, to improve diesel fuel oil and as a catalyst in the making of plastics.

get ready with CONE for tomorrow

The Ford Motor Company has announced its intention of erecting a $50 million laboratory for automotive research and engineering.

get ready with CONE for tomorrow

"Palestic" is a treatment for plaster which makes it as hard and strong as stone and also makes it adhere to plastics, metal or glass.

get ready with CONE for tomorrow

Tennessee Eastman claims that its Tenite plastic pellets blown from an ordinary blasting machine put a fine finish on aluminum castings.

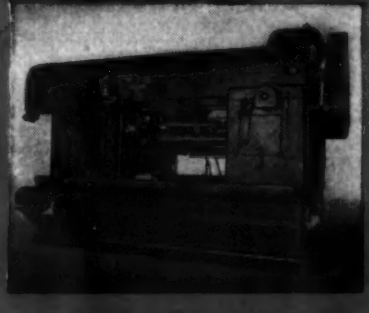
FOLLOW THESE PAGES FOR NEWS OF PROGRESSIVE PRODUCTION

A TON of Chips every 15 hours

Every 15 hours a 5" 4-spindle Conomatic removes a ton of chips from SAE X-1315 bar stock to produce this piece within the time and tolerances required.

***You* can be ahead with a Conomatic.**

Ask your CONE representative to show you our new color motion picture



CONE

AUTOMATIC MACHINE CO., INC. ★ WINDSOR, VERMONT, U.S.A.

33

AIR-O-LIMIT *Accuracy*

Compressor housings are checked at the honing operation with a Model D Air-O-Limit Gage.

Checking the inner race of a bearing at the grinding machine with a Model E Air-O-Limit Gage.

AT EVERY STEP MEANS *Quality Control*

You can reduce rejections and increase production with Pratt & Whitney Air-O-Limit Comparators. These small, compact precision gages can be used right at the machine where there is a handy air connection. They are the key to *quality control.*

Air-O-Limit Comparators are simple and foolproof. They enable an operator to make a fast and accurate check of the sampled workpieces, record their variations and determine whether or not they are within the established control limits.

You will find Air-O-Limit Comparators dependable for a dozen gaging jobs. They will check for I. D. or O. D., roundness, taper and bellmouth.

Remember that quality cannot be improved by final inspections. Save time and money by governing the quality of your products as you build them. For further information on Air-O-Limit Comparators consult your nearest P&W branch office or write directly to us.

PRATT & WHITNEY

Division Niles-Bement-Pond Company

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FOR BETTER PERFORMANCE

Fit the Coupling to the Job...

LORD
SHEAR TYPE
Bonded Rubber
FLEXIBLE COUPLINGS

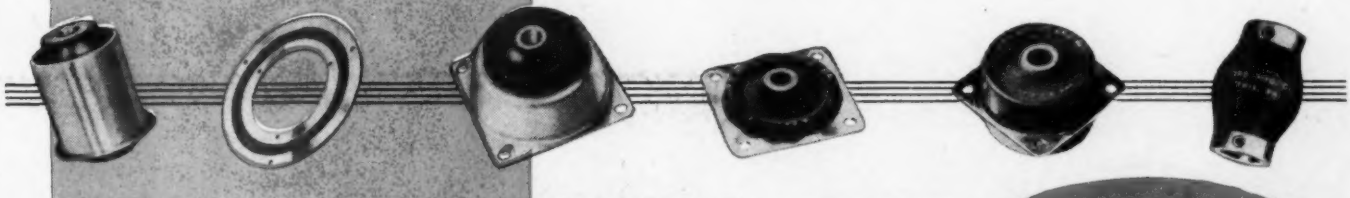
What Lord Flexible Couplings Will Do for You

1. Absorb torque to approximately 20°, between motor and driven unit.
2. Accommodate angular or parallel misalignment.
3. Prolong the life of bearings, on motor and machine.
4. Reduce installation costs, by eliminating necessity for precise alignment.
5. Absorb the strain of shock loads—starting, stopping, stalling—throughout the assembly.
6. Absorb the force of end and radial thrusts.
7. Provide for even flow of power from motor to unit in work.
8. Reduce noise by eliminating transmission of noise through the shaft.
9. Give protection to the driving motor from suddenly imposed excessive overload.

Too often Flexible Couplings are selected without consideration of the EXTRA services which they can render; such as the absorption of momentary impulses for smoother power delivery, elimination of shaft alignment difficulties, noise reduction, protection to equipment, etc. No single coupling can provide these EXTRAS over a wide range of power. That is the reason LORD FLEXIBLE COUPLINGS are available in many sizes up to and including 1-HP.—so you may fit your requirements exactly and obtain *all* of the advantages available from engineered coupling design.

By permanently bonding rubber (or neoprene to resist oil) between steel hubs in such a manner as to stress the rubber section in shear, LORD has obtained an unusual amount of torsional resiliency for shock absorption. Since all movement is accommodated within the rubber, there is no frictional wear or chafing to shorten coupling life. For the best in advanced coupling design, use LORD FLEXIBLE COUPLINGS.

Write for Bulletin 200-A which describes LORD FLEXIBLE COUPLINGS in greater detail.



Every genuine Lord Mounting carries the name "LORD" embossed in the rubber or in raised letters on the forgings.

IT TAKES BONDED RUBBER *In Shear* TO ABSORB VIBRATION

LORD MANUFACTURING COMPANY
ERIE, PENNSYLVANIA

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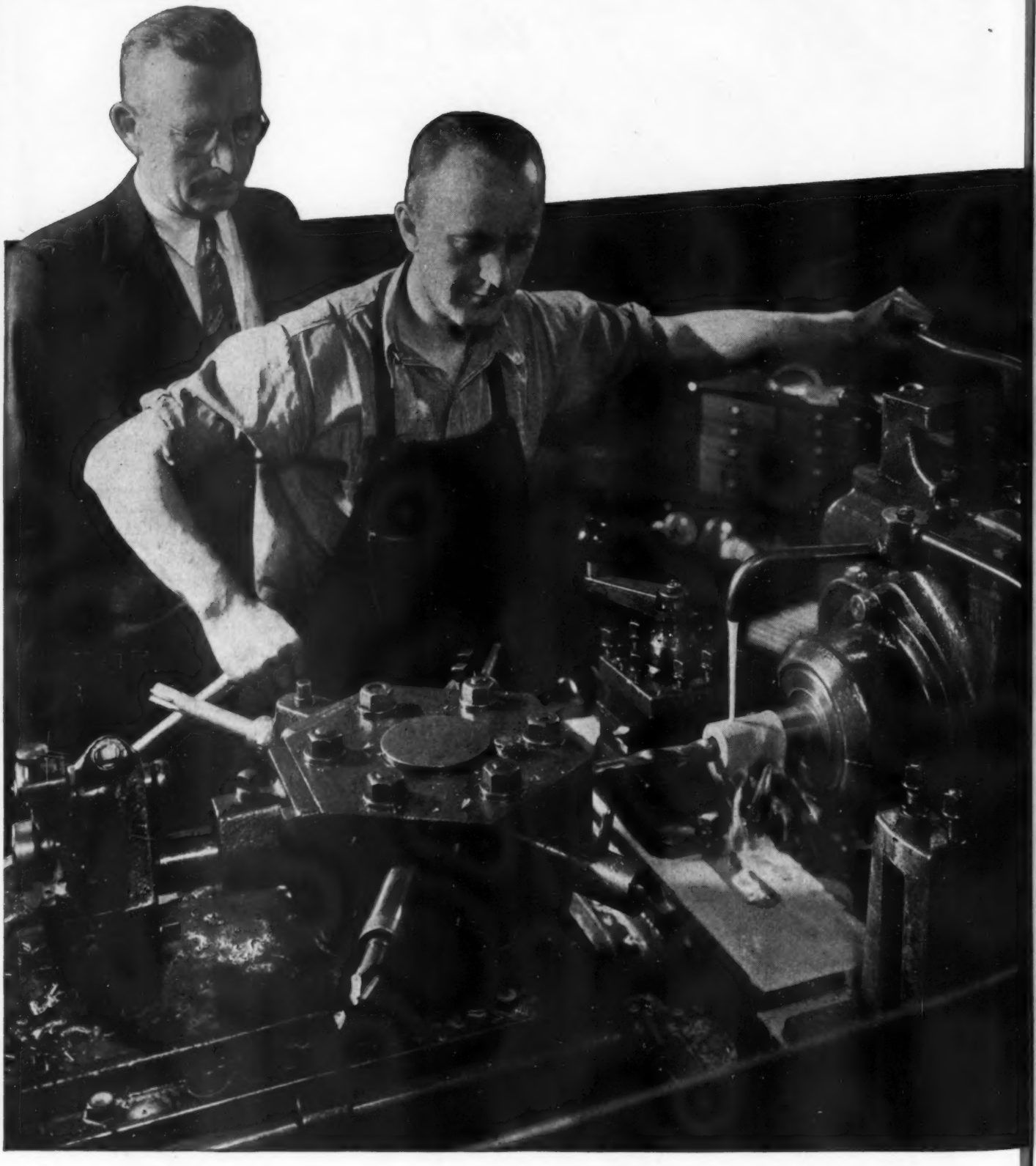
WASHINGTON - 14TH & G STREETS, N. W.
CANADIAN REPRESENTATIVES
ARMSTRONG & POWER ENGINEERING CORP., LTD.
TORONTO, CANADA

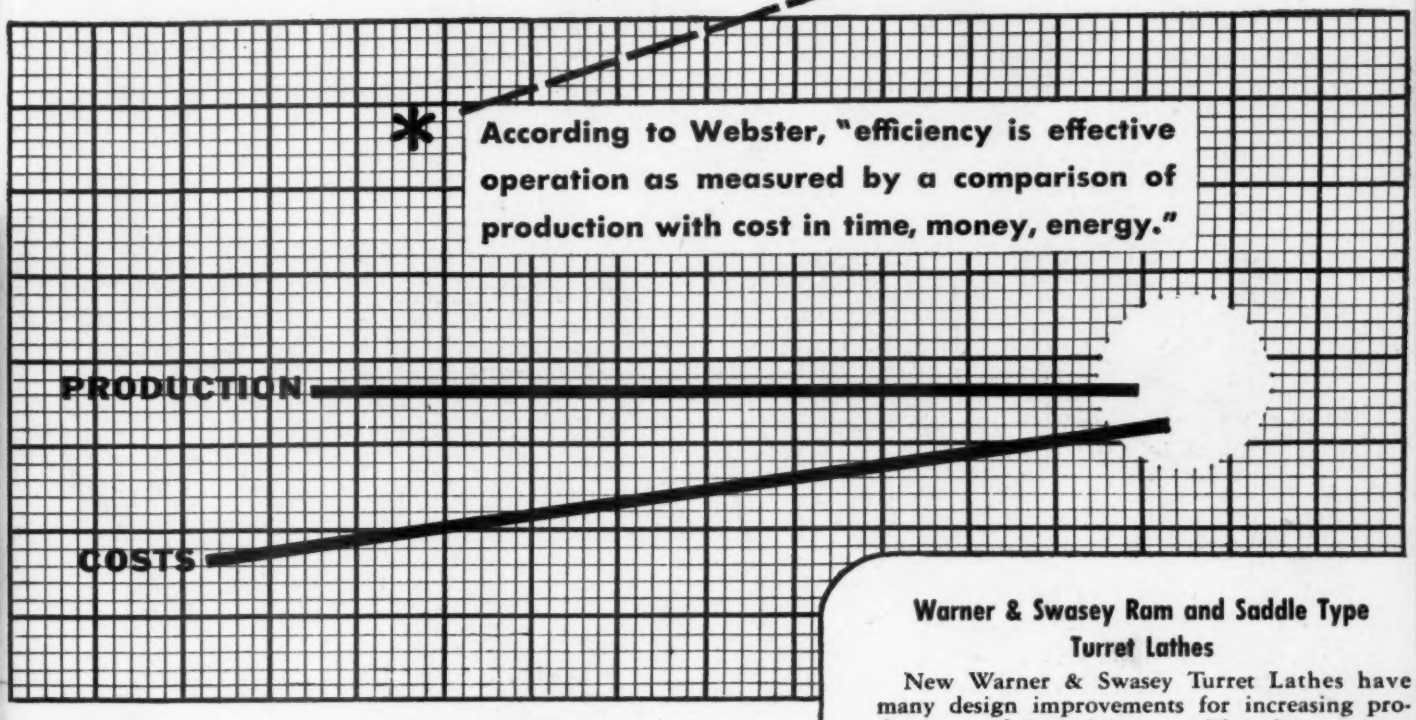
Originators of Shear Type Bonded Rubber Mountings

When does a machine tool



TURRET LATHES, MULTIPLE SPINDLE AUTOMATICS, PRECISION TAPPING AND THREADING MACHINES

lose its Efficiency?*


* According to Webster, "efficiency is effective operation as measured by a comparison of production with cost in time, money, energy."
PRODUCTION
COSTS

ARE YOUR SHOP COSTS RISING FASTER THAN YOUR PRODUCTION?

IF YOUR PRODUCTION CURVE is not keeping pace with advancing costs and an increasing number of orders, perhaps the whole trouble can be found in machine tools which have lost their efficiency even though they produce as much as ever.

For measurement of efficiency is not static; rising labor and material costs and a need for faster production to satisfy greater demands have advanced the retirement age of many machines.

Warner & Swasey field engineers are skilled in analyzing production needs from a machine tool standpoint. Perhaps one of them can find ways of stepping up the productivity of your present machines through new tools or accessories, or, if replacement is necessary, he can advise you on the right type or model.

For peak machine tool efficiency—choose a Warner & Swasey.

Warner & Swasey Ram and Saddle Type Turret Lathes

New Warner & Swasey Turret Lathes have many design improvements for increasing production and lowering costs. They have greater power for taking heavier combined cuts at higher speeds. Their rigidity holds extreme precision on large chucking operations as well as on small work pieces to minimize scrap loss.

Warner & Swasey Multiple Spindle Automatics

With the new Warner & Swasey Bar and Chucking Automatics, small and medium lots as well as long runs are both practical and profitable. A patented Quick-Set mechanism eliminates cam changes, speeds and simplifies changing to new setups.

Warner & Swasey Precision Tapping and Threading Machines

The new and radically different leading-on principle of Warner & Swasey Tapping and Threading Machines insures faster production of class 3, 4 and 5 gage fits. An automatic clutch reduces tap breakage. Scrap losses due to thread errors are practically eliminated.

WARNER & SWASEY
Machine Tools
Cleveland

You Can Machine it Better, Faster, for Less... with a Warner & Swasey

8 Quick Moves TO LOWER MILLING COSTS

Jump at the opportunity to reduce your milling costs by utilizing Kempsmith standard attachments. These precision-built tools make it possible for you to convert your standard milling machine into a special purpose miller, thereby reducing costs to rock bottom. Kempsmith Attachments, Arbors and Accessories have long proven their ability to handle both delicate tool room jobs and fast production runs. They have the same high degree of precision workmanship and accuracy characteristic of Kempsmith machines for more than 57 years. It will pay you to investigate.

THE KEMPSMITH MACHINE COMPANY, MILWAUKEE 14, WIS., U. S. A.

Let an experienced Kempsmith Engineer show you how to apply Kempsmith Standard Attachments to your milling jobs. There's no obligation and it may lead to substantial savings in costs. Write for literature.

KEMPSMITH *Attachments and Arbors!*

Precision Built Milling Machines Since 1888

A 5076-1P

YOU CAN SHAVE A GEAR A LOT FASTER than you can grind it

Gears requiring 40 minutes (floor to floor) for grinding are being shaved in just 5 minutes.

The shaved gears are just as accurate dimensionally as the ground gears; tooth surfaces are just as smooth and of equal if not greater importance, the shaved gear teeth are entirely free of those prevalent hairline grinding cracks which so often result in fatigue failures. Thus by shaving you get better gears faster and at less production cost.

Gears are shaved on Red Ring Rotary Shaving Machines which produce smooth tooth surfaces and correct errors of helical angle, profile and eccentricity. Gears from 3/16" to 220" P. D. can be shaved. Those from 3/8" to 36" P. D. can also be crowned to avoid the danger of failure due to "End Bearing."

NATIONAL BROACH AND MACHINE CO.

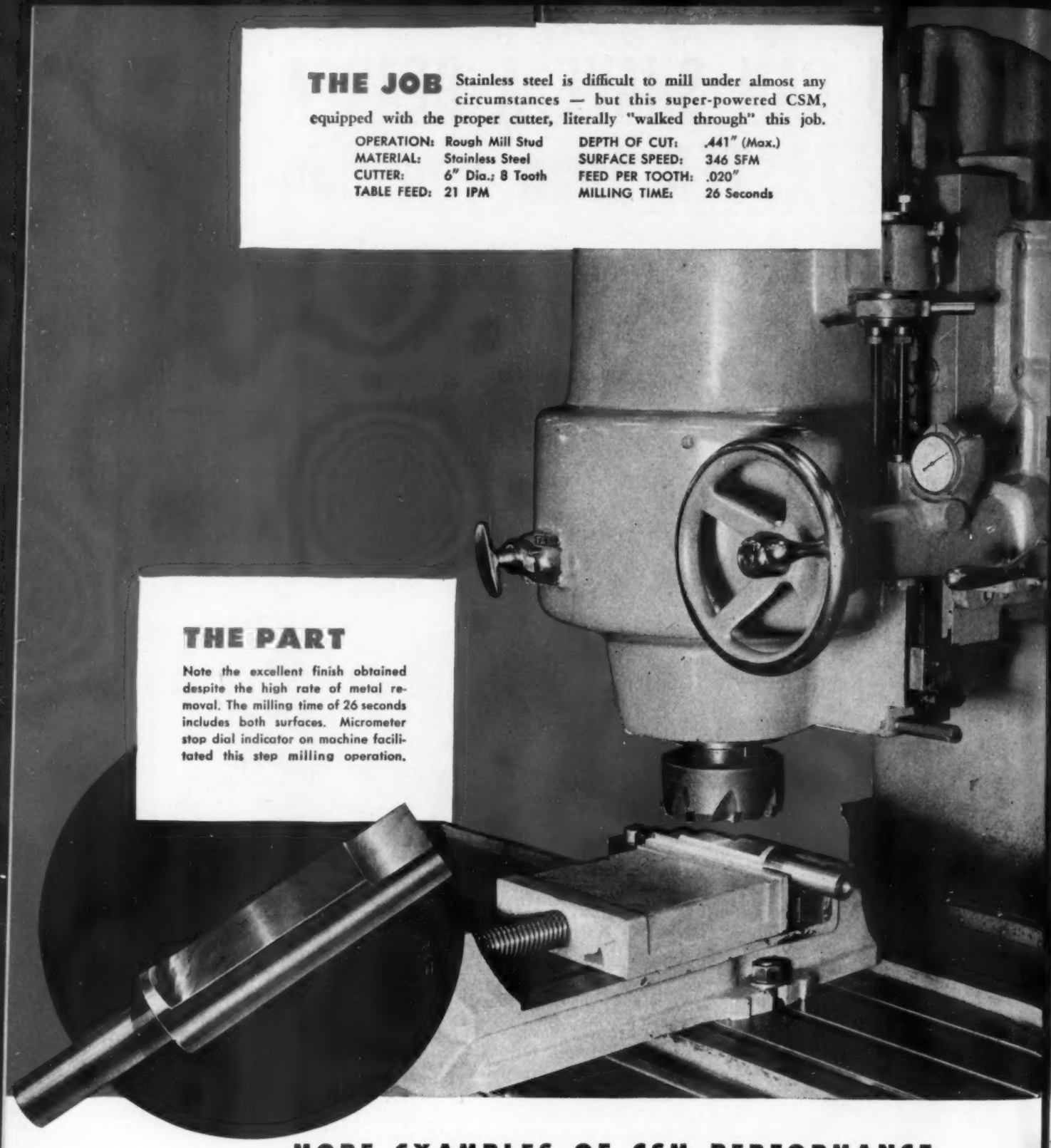
5600 ST. JEAN — RED RING ◯ PRODUCTS — DETROIT 13, MICH.

SPECIALISTS ON SPUR AND HELICAL INVOLUTE GEAR PRACTICE

ORIGINATORS OF ROTARY SHAVING AND ELLIPTOID TOOTH FORMS

THE JOB Stainless steel is difficult to mill under almost any circumstances — but this super-powered CSM, equipped with the proper cutter, literally "walked through" this job.

OPERATION:	Rough Mill Stud	DEPTH OF CUT:	.441" (Max.)
MATERIAL:	Stainless Steel	SURFACE SPEED:	346 SFM
CUTTER:	6" Dia.; 8 Tooth	FEED PER TOOTH:	.020"
TABLE FEED:	21 IPM	MILLING TIME:	26 Seconds



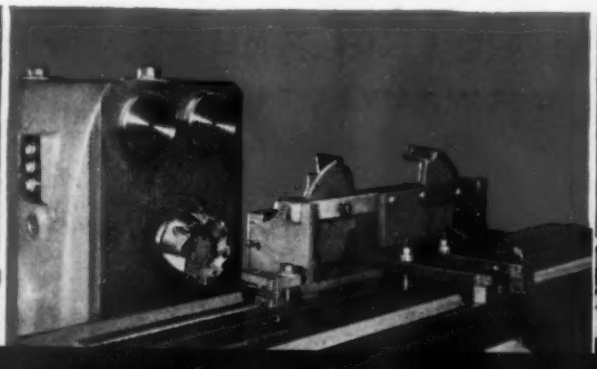
THE PART

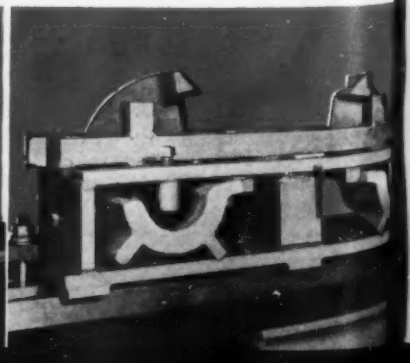
Note the excellent finish obtained despite the high rate of metal removal. The milling time of 26 seconds includes both surfaces. Micrometer stop dial indicator on machine facilitated this step milling operation.

MORE EXAMPLES OF CSM PERFORMANCE

Operation: Rough mill angle on knee gib support—with 34% time reduction. Material: C. I.—Speed: 336 sfm—Cutter: 3" dia., 8 T.—Feed per tooth .010"—Depth of Cut: 5/32". Previous Milling time: 61 seconds — CSM Milling time: 45 seconds.

Two views of set up for milling socket arm part with 65% milling time reduction. Center shows rear of special holding fixture in place on machine table. At right, machined surfaces of part. Material: Cast Steel—Surface Speed: 346 sfm—Cutter: 6" dia., 8 Tooth—Feed per tooth: .012" —Depth of cut ¼". Previous milling time: 4 min. 52 seconds—CSM milling time: 1 min. 42 sec.





STAINLESS STEEL MILLING

made easy on a

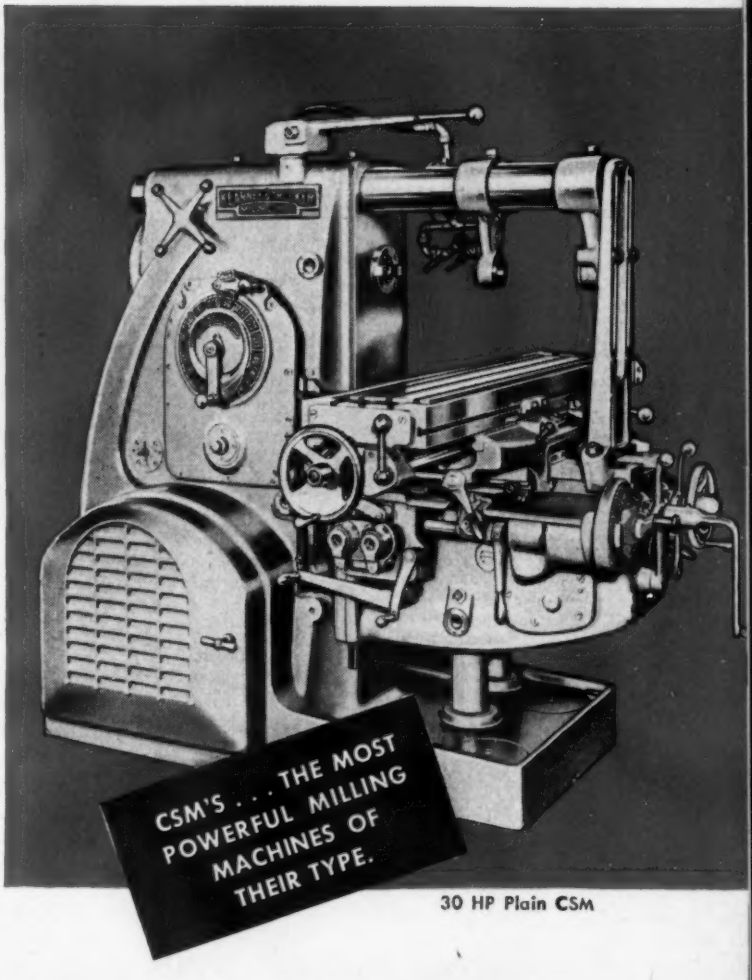
KEARNEY & TRECKER CSM

CSM Milling Machines were designed to obtain the greatest benefits from modern cutting tools, and are now part of our line of standard models. The design has been stabilized after complete analysis of industry's problems of milling with carbide cutters.

Because they are knee type machines, they are readily adaptable to a great variety of work. They are precision built in accordance with long established Kearney & Trecker standards and will cut metals faster and to finer tolerances and superior finishes than ever before — with high speed steel cutters as well as carbide cutters.

CSM machines are available in 20, 30 or 50 H.P. models in both plain and vertical knee types.

Write for complete data on CSM machines — CATALOG CSM-20. Please indicate your business connection.



30 HP Plain CSM

KEARNEY & TRECKER CORPORATION

MILWAUKEE 14, WISCONSIN

472

"Be ready for tomorrow with **CSM's**"

Jim Smith's Son

COST JIM'S EMPLOYER

$4,109.16

Jim Smith's son was born last week. He cost Jim's employer over $4,000.

Jim has had pretty heavy expenses lately. His little girl was taken to the hospital three months ago for an emergency operation. Now, the baby. Jim has worried a lot about the doctor and hospital bills.

Yesterday he had an accident, because his mind wasn't on his work.

Workmen's compensation insurance will pay Jim's doctor and hospital bills. It will pay his weekly compensation benefits. But it will not pay him for his suffering. Nor will it pay for the damage to the machine or the material spoiled. That will cost his employer $4,109.16—which does not include the lost time of dozens of other men who saw the accident and stopped to talk about it, and who will worry about it for days afterwards.

Employers Mutuals write:

Public Liability . . . Automobile . . . Plate Glass . . . Burglary . . . Workmen's Compensation . . . Fidelity Bonds . . . Group Health, Accident, Hospitalization . . . and other casualty insurance . . . Fire . . . Tornado . . . Extended Coverage . . . Inland Marine . . . and allied lines of insurance. All policies are nonassessable.

Branch offices in principal cities. Consult your telephone directory.

EMPLOYERS MUTUALS of WAUSAU

OFF THE JOB... this complete 24-hour protection provides peace of mind for your employees

To supplement your workmen's compensation insurance, Employers Mutuals of Wausau provide for complete 24-hour protection for employees and their families through Group Health, Accident, and Hospitalization insurance.

This plan can be tailored to your requirements. It can give varying degrees of protection to various types of workers, as desired. It assures you, and your employees, that they are protected—on the job or off the job, for 24 hours a day—it frees them from worry about medical, surgical, and hospital bills for themselves and for their dependents.

Peace of mind is the greatest single contribution you can make toward the efficiency of your employees. With it, they work better and produce more; the accident rate drops, and with it the cost of your other insurance.

Investigate this plan now. Call the nearest Employers Mutuals office, or write Insurance Information Bureau, Employers Mutuals of Wausau, Wausau, Wisconsin.

ON THE JOB... safety engineering cuts down accidents, saves manhours, reduces insurance costs

Workers naturally prefer pay checks to compensation checks. When you carry Employers Mutuals Workmen's Compensation, E-M Safety Engineering helps keep your employees on the job and out of the hospital.

This service cuts accident frequency rates substantially—with resulting savings in insurance costs. Savings often run from 20 to 40%—in many cases even more.

E-M safety engineers, experienced through years of contact in many plants, are able to eliminate many sources of danger you might not notice. They help you plan and organize a program to interest and instruct the workers in safety so that they will understand how taking time to be safe saves time. Coordinated with the safety engineering work, Employers Mutuals industrial nurses help set up a plant nursing service to guard the health of employees and render efficient first aid.

When there are accidents, claims are given prompt attention. If he needs it, the injured worker is treated in one of Employers Mutuals modern physiotherapy laboratories, which speeds his recovery and many times prevents permanent disability. Employers Mutuals often spend more for rehabilitation than compensation would cost.

E-M Engineering Service, by reducing accidents, reduces time lost by valuable employees. It benefits the worker who doesn't get hurt, as well as the employer whose insurance cost is lowered when accidents do *not* happen.

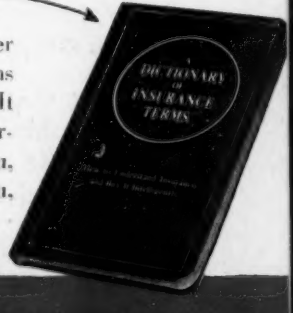
HOW Employers Mutuals of Wausau Make Insurance Understandable

Because of the serious loss that may arise from lack of understanding, Employers Mutuals endeavor to make insurance understandable, through:

- . . . representatives trained to help the buyer understand his insurance;
- . . . insurance survey service, which provides policyholders with an analysis of their insurance coverage—what they have, and what they need for full protection;
- . . . an advertising program dedicated to giving *information* about insurance; and . . .
- . . . A Dictionary of Insurance Terms—How to Understand Insurance and Buy It Intelligently. Over 200 words and phrases defined in simple ABC English, with examples of specific applications.

FREE

The BIGGEST little book on insurance ever published—A Dictionary of Insurance Terms—How to Understand Insurance and Buy It Intelligently? Write on your business letterhead to: Insurance Information Bureau, Employers Mutuals of Wausau, Wausau, Wisconsin.



. . . make Insurance Understandable

EMPLOYERS MUTUAL LIABILITY INSURANCE COMPANY OF WISCONSIN
ESTABLISHED 1911
EMPLOYERS MUTUAL FIRE INSURANCE COMPANY
ESTABLISHED 1935
Home Office: WAUSAU, WISCONSIN

Progressive Operations

are easy
fast and
economical
on the

FOSDICK
HIGH SPEED DRILL

● On work requiring progressive operations such as drilling, reaming, counterboring and tapping the six spindle Fosdick High Speed Drill speeds up production and lowers costs.

For example on the job shown drilling, reaming and tapping operations are being performed successively. Work moves from spindle to spindle until all operations are completed.

Start, stop and speed changes for motors are accomplished by pushbuttons conveniently located at front for the operator. Six and nine spindle speeds are obtainable with standard 1800 R. P. M. motor. With a two speed motor

12 and 18 speeds are available.
Thus ease of control and flexibility of operation, permits work requiring holes up to 1¼" diameter, to be handled easily, quickly and economically on a Fosdick High Speed Drill.

For full details of construction —operation and various types and models available, write for the Fosdick High Speed Bulletin—H. S. A.

FOSDICK MACHINE TOOL COMPANY
CINCINNATI 23, ··· OHIO

BARBER-COLMAN

HOBS • HOBBING MACHINES • HOB SHARPENING MACHINES • MILLING CUTTERS
REAMERS • REAMER SHARPENING MACHINES • SPECIAL TOOLS

NO. 3 HOBBING MACHINE IS USED TO CUT AN EXTREMELY HIGH-PRECISION QUADRANT GEAR

Close-up showing how a hard bronze quadrant gear is held on a Barber-Colman No. 3 Hobbing Machine to cut 21 teeth, spur form, to unusually close tolerances, and with extra fine finish.

This 21-tooth quadrant gear, made of hard bronze, is one-cut finish hobbed on a Barber-Colman Standard No. 3 Hobbing Machine, holding .0005" concentricity, and .0002" tooth interference (rolled with master at zero backlash). Total cutting time is only 21 minutes in spite of the fact that the machine is "cutting air" a good part of the time. This job demonstrates not only the *high precision* of the B-C No. 3 Hobbing Machine, but also its *versatility* and capacity for *high production.*

ADAPTABLE TO VARIETY OF GEAR JOBS

This particular machine is not a "special", made for one job. It is a standard machine easily and quickly set up for producing spur gears, helical gears and spline shafts of various kinds. If you have a Barber-Colman No. 3 Hobbing Machine in your plant, remember that *this machine is not only highly accurate, but also versatile.* If you are in doubt as to the applicability of a certain piece to this machine, consult your Barber-Colman representative for advice and engineering information.

JOB FACTS

Piece. Quadrant Gear, hard bronze casting, 21 teeth (117 full gear), 32 pitch, outside diameter 3.718", spur form 14½° P.A., ¼" face. Tolerances listed in text.

Set-Up. Conventional cut, feed .025" per rev. of work, hob speed 133 r.p.m. Special arbor and driver as shown. B-C Precision Ground Topping Hob.

Production. 21 min. floor-to-floor. Hob life 750 pieces per grind, 5 settings—excellent for hard bronze.

BARBER-COLMAN COMPANY

HOBS, HOBBING MACHINES, HOB SHARPENING MACHINES, REAMERS, REAMER SHARPENING MACHINES, MILLING CUTTERS, SPECIAL TOOLS

GENERAL OFFICES AND PLANT • 111 LOOMIS STREET • ROCKFORD, ILLINOIS, U.S.A.

Get Three Big Advantages

- Greater Accuracy
- Higher Production Rate
- Lower Cost

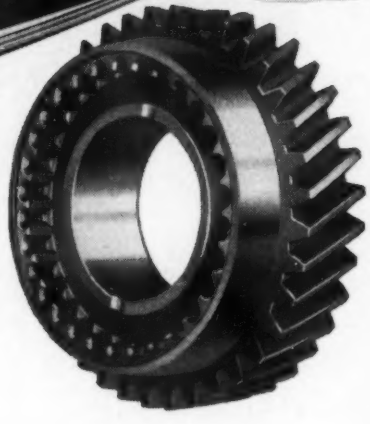
with Unskilled Operators

HERE is another example of how a Cross machine, utilizing "Selected Sequence" in automatic cycle operation, met the requirements by producing more accurately, at a higher production rate, at lower cost, with an unskilled operator. Further, it made possible a change in product design which added strength to the gear it produced, and improved resistance to sudden or heavy torque loads.

The No. 52 Milling Machine is made up of standard machine parts to provide a low cost, compact unit for specialized requirements, yet readily adaptable to a wide variety of work—for profile milling, for milling numbers of equally spaced internal or external slots, or for diversified operations on gears.

In action, the special form end mill rapidly advances horizontally to a predetermined position inside the gear and then feeds upward. After milling, the cutter retracts quickly to clear the cut, and the fixture automatically indexes to the next position. The programmed sequence of the automatic cycle is interlocked for safety.

Without obligation, we will be glad to analyze your production problems, and make recommendations. Consult Cross to cut cost.



Producing ten gears hourly, this form tool method of gear tooth milling eliminates one drilling and one relief turning operation.

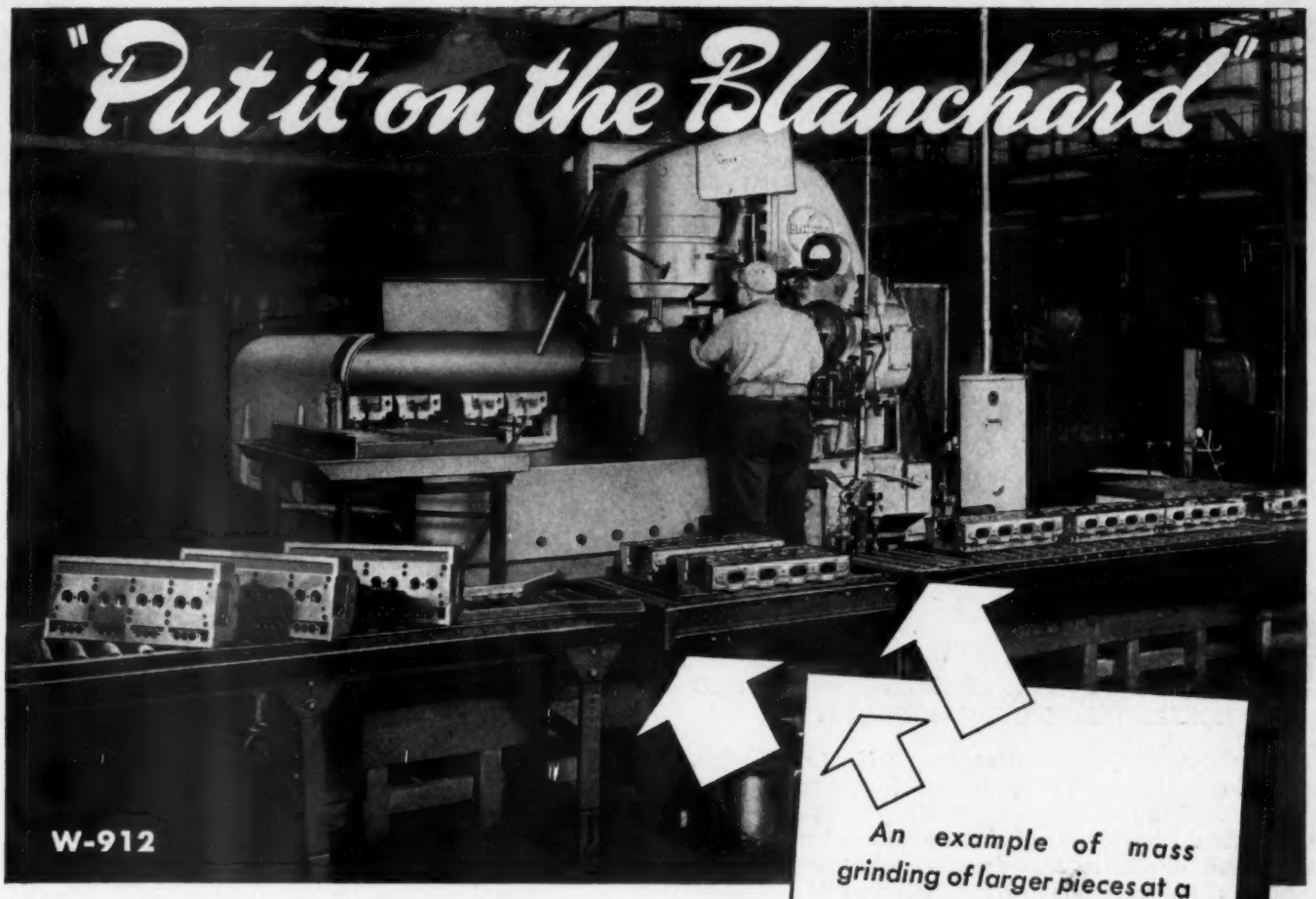
THE **CROSS** COMPANY

Established 1898

SPECIAL MACHINE TOOLS

DETROIT 7, MICHIGAN

MILLING • DRILLING • TAPPING • BORING • TURNING • SHAPING • GRINDING • HONING



An example of mass grinding of larger pieces at a greater profit.

Four diesel cylinder heads are held on a 60" magnetic chuck of a No. 27 Blanchard Surface Grinder. The material is cast iron. Each head measures 25½" x 10¼" x 5 3/16".

Average stock removal per side is .005". One side is ground flat within .001".

Production is 27 pieces (27 surfaces) per hour. This includes loading and unloading time.

THE MOST PROFITABLE WORDS IN FLAT SURFACE GRINDING

Whatever type of flat surface grinding your parts may require—be it simple "cleaning up"—or rough grind *and* finish grind in *one* operation—or very flat surfaces with a fine finish and held to close limits—*there is no more profitable method,* in practically all cases, than to "Put it on the Blanchard."

Blanchard's specialization in grinding flat surfaces assures you the most profitable flat surface grinding machines you can buy.

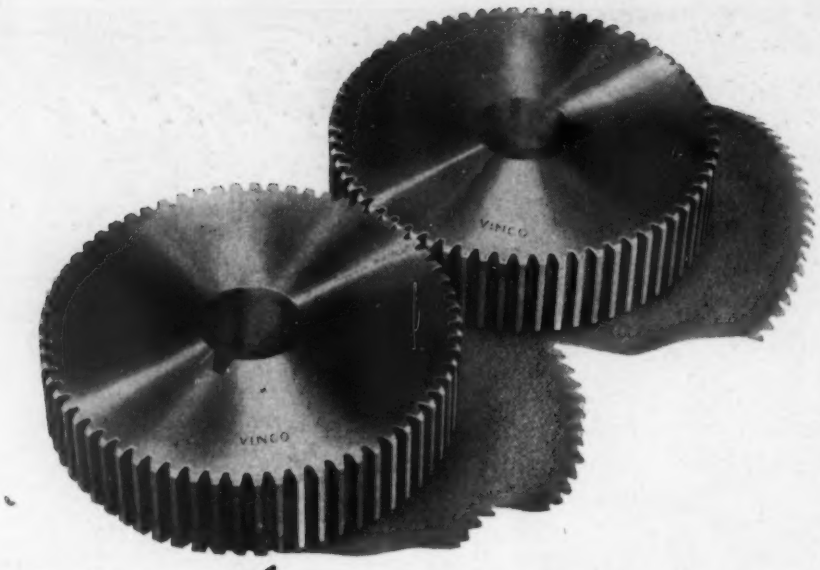
IF YOU MACHINE FLAT SURFACES . . . bring your problems to The Blanchard Machine Company.

Send for your free copy of "Work Done on the Blanchard", third edition. This new book shows over 100 actual jobs where the Blanchard Principle is earning profits for Blanchard owners.

BLANCHARD

The BLANCHARD MACHINE COMPANY

64 STATE STREET, CAMBRIDGE 39, MASS., U. S. A.



How do you *know* they'll work?

The easiest and most accurate way to determine the acceptability of gears is to check them on a VINCO GEAR ROLLING INSPECTION FIXTURE.

These widely used fixtures combine simplicity of design, ease of operation and structural quality of the highest. They provide a fast, accurate check of concentricity and backlash, duplicate assembly conditions wherever possible and eliminate mathematical computations. All readings are direct and clearly visible on dial indicators. Inspection time is reduced and very little floor or bench space is required—size range starts from 6¾″ x 9″. Another feature of all VINCO GEAR ROLLING INSPECTION FIXTURES is Easy Loading of Parts, a result of loading directly on the bearing surfaces. This eliminates the placing of work on an arbor, installing the arbor between centers and the resulting tendency to incorporate additional errors into the indicator readings. Cut gear rejections at final assembly to a new low with VINCO GEAR ROLLING INSPECTION FIXTURES. Write today for your copy of Bulletin No. 91 and learn more about these fixtures.

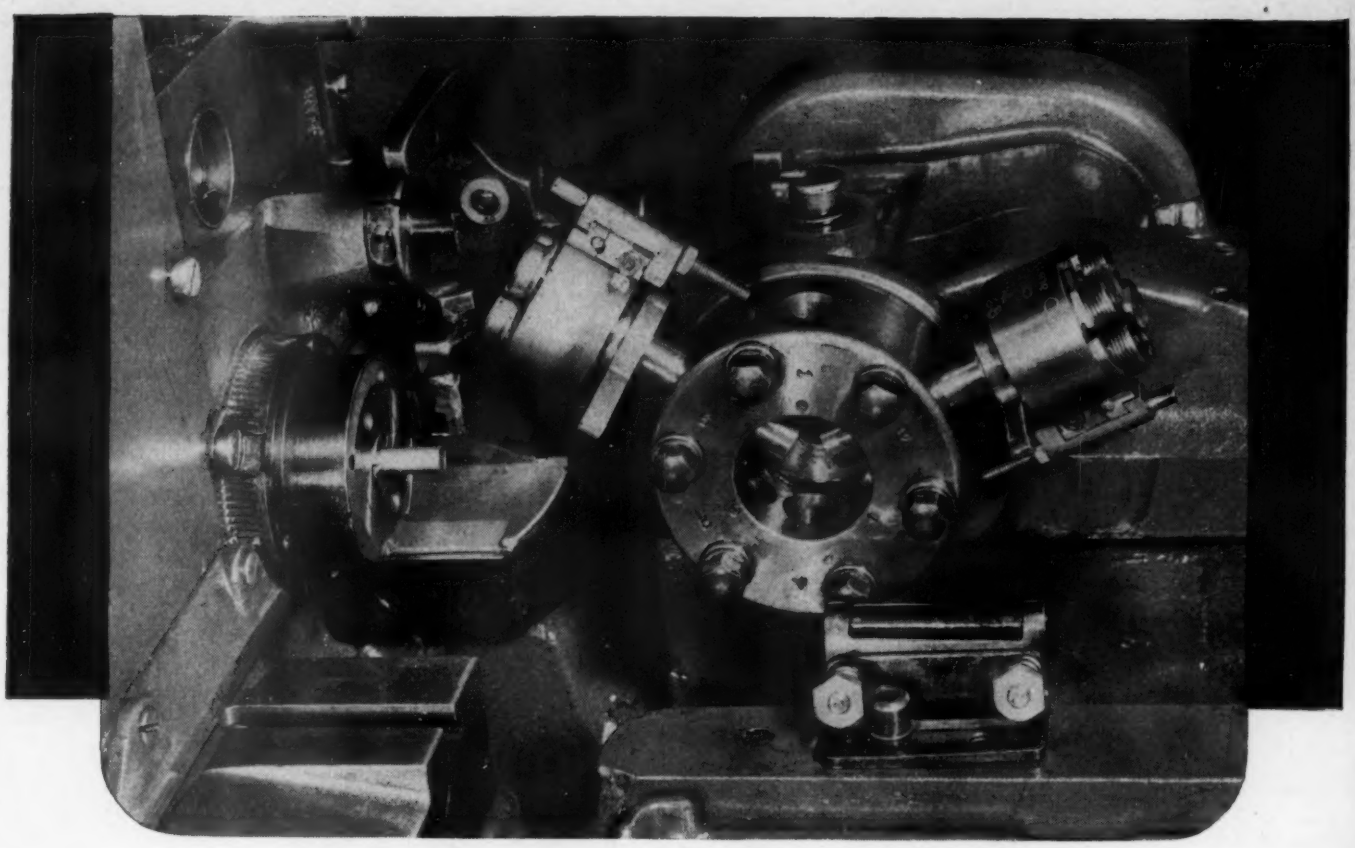
The photo, at left, shows a Dual-Purpose Type Gear Rolling Inspection Fixture in position to check backlash. For general purposes VINCO Gear Rolling Fixtures are made in two types — the Dual-Purpose for gears being manufactured in quantity production, and the Dual-Purpose Adjustable for the inspection of different gears, with similar mounting conditions, being produced in short runs. Both types will allow a 100% or spot check.

MILLIONTHS OF AN INCH FOR SALE BY VINCO

REG. U. S. PAT. OFF.

VINCO CORPORATION, 8851 SCHAEFER HIGHWAY, DETROIT 27, MICHIGAN; SALES OFFICES, NEW YORK, CHICAGO, CLEVELAND

Semi-Automatic Hydraulic Spline and Gear Grinder • Optical Master Inspection Dividing Head • Involute Checker • Angle Tangent to Radius Dresser • Index Plates • Precision Vises • Sine Bars • Straight-side Spline, Serration Spline, Involute Spline and Helical Spline Plug and Ring Gages • Thread Plugs, Rings and Setting Plug Gages • Spur and Helical Master Gears • Munition Gages • Propeller Shaft and Hub Gages • Built-up and Special Gages • Gear Rolling Inspection Fixtures • Indexing Fixtures • Hydraulic Power Control, Utilization and Distribution Units • Engineering, Design and Development • Precision Production Parts.



NEW POSITIVE-ACTING VERS-O-TOOL DIE HEAD

For Brown and Sharpe Automatics

Here's a die head that doesn't miss. Positive cam action closes the head and *keeps* it closed during the non-cutting part of the cycle. And the famous Namco Vers-O-Tool action insures automatic opening when the *exact* length of the cut has been reached.

Literature and prices on request.

EXCLUSIVE VERS-O-TOOL FEATURES

- Interchangeable circular milling cutters and ground thread chasers
- Multiple cutting through four circular cutters
- Close limits of tolerance and concentricity
- Quick diametric adjustment
- Micrometer control for regrinding
- Hardened and ground parts for long life and accuracy

The NATIONAL ACME CO.

170 EAST 131st STREET • CLEVELAND 8, OHIO

Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog • Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

19 Years of Dependability

on DODGE-TIMKEN PILLOW BLOCKS

The Dodge-Timken Pillow Blocks pictured above were installed in the sawmill and lumber manufacturing plant of the Hills Creek Lumber Company of Jasper, Oregon, over 19 years ago. This company selected Dodge-Timken Pillow Blocks because they wanted smooth-running bearings which would give years of dependable service with minimum operating and maintenance expense.

This 19-year record of fine performance is proof again that leading manufacturers specify Timken Bearings in their operating equipment because they know this means greater endurance, reduced operating costs and minimum attention for maintenance.

They know that Timken Bearings assure friction-free operation; proven ability to carry radial, thrust and combined loads while holding parts in correct and constant alignment; and simple lubrication.

Be sure that the trade-mark "TIMKEN" is stamped on every bearing you use.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS

HARDINGE
ELMIRA, N.Y.

HIGH SPEED PRECISION LATHE

for Rapid, Accurate Work in Tool Rooms, Laboratories and Development Departments

The problem today is to produce parts to exacting close tolerances at low cost. The DV 59 Hardinge High Speed Precision Lathe has the perfect combination of accuracy and speed together with rugged construction so necessary for lasting precision. Simplicity of operation enables relatively-unskilled operators to produce parts to close limits.

Optical accuracy is now necessary for industry generally — that is why the Hardinge hardened and ground steel dovetail bed construction, standard for special accuracy lathes for the optical industry, is now featured for Hardinge precision lathes. Write for Bulletin DV 59 which presents full particulars about this greatest advance in precision lathe construction.

SPECIFICATIONS

1" collet capacity, 9" swing, 17" center distance, 8 spindle speeds up to 4000 r.p.m.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

NO. 5 ADAMS
GEAR HOBBER
AND THREAD MILLER

A PRECISION MACHINE WITH EXCEPTIONAL FLEXIBILITY

★ **THE AUTOMOBILE MANUFACTURER—**
will appreciate the accuracy and productive ability of these machines for splining transmission shafts and for hobbing transmission gears, steering worms, etc.

★ **THE MACHINERY BUILDER—**
will find the No. 5 useful in the production of spur and helical gears, splined shafts, worms, lead screws, etc.

★ **THE GEAR MANUFACTURER—**
can use them to advantage on a large variety of his work and he will find simplicity of setups to be one of the features.

DESCRIPTIVE LITERATURE SENT ON REQUEST

ADAMS

THE ADAMS COMPANY
DUBUQUE, IOWA

ESTABLISHED 1883

A Size and Type for Every Polishing Job . . . ALUNDUM ABRASIVE

WHETHER you are roughing, semi-finishing and finishing in one set-up, as illustrated, or are doing the three operations separately you can be sure of getting ALUNDUM Abrasive in just the right grain sizes for your jobs—also with just the right surface treatments.

Let a Norton abrasive engineer study your polishing jobs and give definite specifications.

NORTON COMPANY, WORCESTER 6, MASS.

Distributors in All Principal Cities

NORTON ABRASIVES

342 holes held to .0002" limit with JIGMIL automatic positioning

38 x 63 x 2¾" Thick
Steel boiler plate
Hole dia. limit .0001"
Overall Spacing Limit .0002"
The world's finest Jig Boring and Milling Machine

HOOVER TOOL & DIE COMPANY

DETROIT, MICHIGAN

DeVlieg Machine Company
450 Fair Avenue
Ferndale 20, Detroit,
Michigan

Gentlemen:

Enclosed is a photograph showing job done in our shop on the 3B Jig Mill.

PART: Heater Plate
SIZE: 38 x 63 x 2-3/4" thick
MATERIAL: Steel Boiler Plate
HOLE DIA. LIMIT: .0001"
OVERALL SPACING LIMIT: .0002"

As machine table travel is 48", it was necessary to reset work. This did not affect accuracy and the line made was highly satisfactory.

Very truly yours,
HOOVER TOOL & DIE COMPANY
C. W. Richter - Vice President &
Chief Engineer

CWR:ID
Enc. 1

Here are the results obtained by one user of 3-B DeVlieg JIGMILS on a difficult boring operation. The JIGMIL will also cut costs in your plant because:

(1) Only one set-up required for both boring and milling operations.

(2) Centralized Push Button Control Panel and Slide Lock Levers operated through finger-tip pressure.

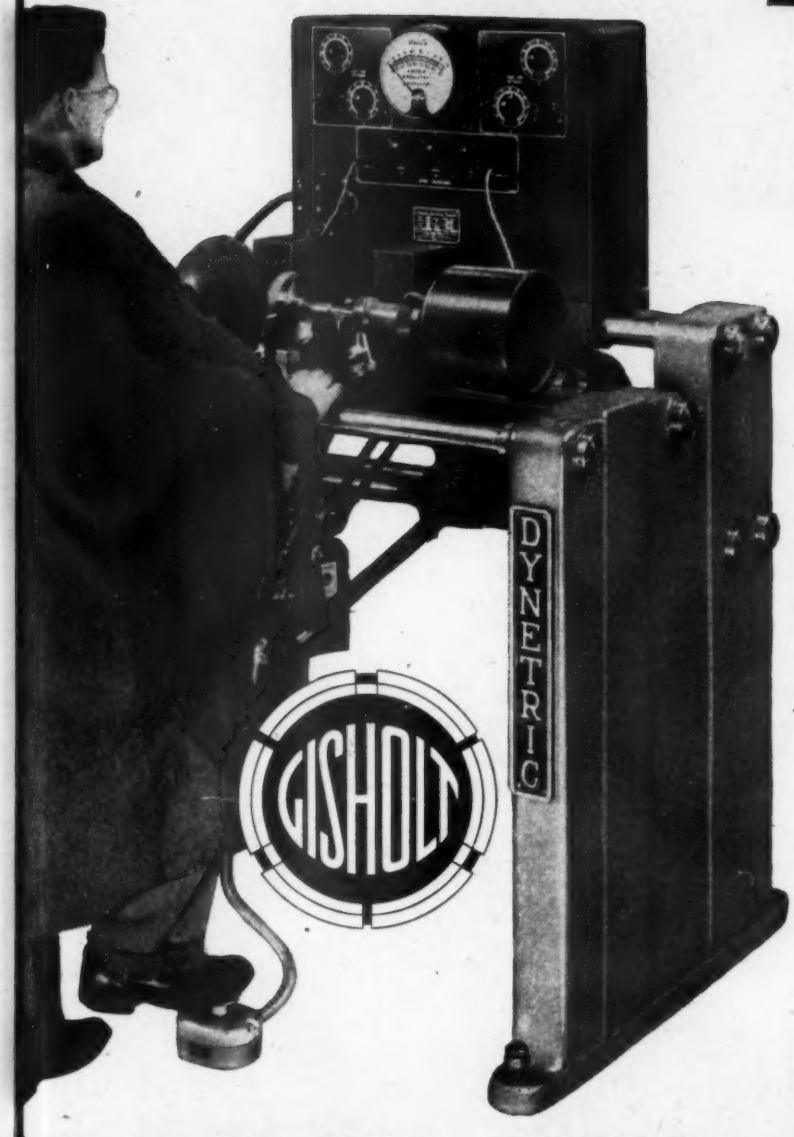
(3) Automatic spacing to within .0001" of setting permits unvarying accuracy on jigs, fixtures and duplicate parts.

Technical literature available upon request. Write today.

DeVLIEG MACHINE COMPANY DEVLIEG JIGMIL **450 FAIR AVE. FERNDALE 20, (Detroit) MICH.**

What in the World have Stockings to do with

DYNETRIC* BALANCING?



Or, we might ask, what would milady do for stockings without Dynetric Balancing?

The manufacture of fine synthetic threads is done at high speed, using bowls or spindles to collect the filament. Mounted at the top of a vertical motor shaft, these bowls are driven at speeds up to 10,000 r.p.m. Any unbalance in the bowls will cause motor bearings to fail after only a few hours of operation.

Through Dynetric Balancing of these parts, the maintenance of driving motors has been practically eliminated so that the thread-making can be a continuous, uninterrupted process.

It's just one more example of the way Gisholt Dynetric Balancing is serving many branches of industry—helping to make better products, more easily and at lower cost. If your product uses rotating parts, regardless of size or weight, get the facts about Dynetric Balancing.

**Developed jointly with Westinghouse Electric Corporation*

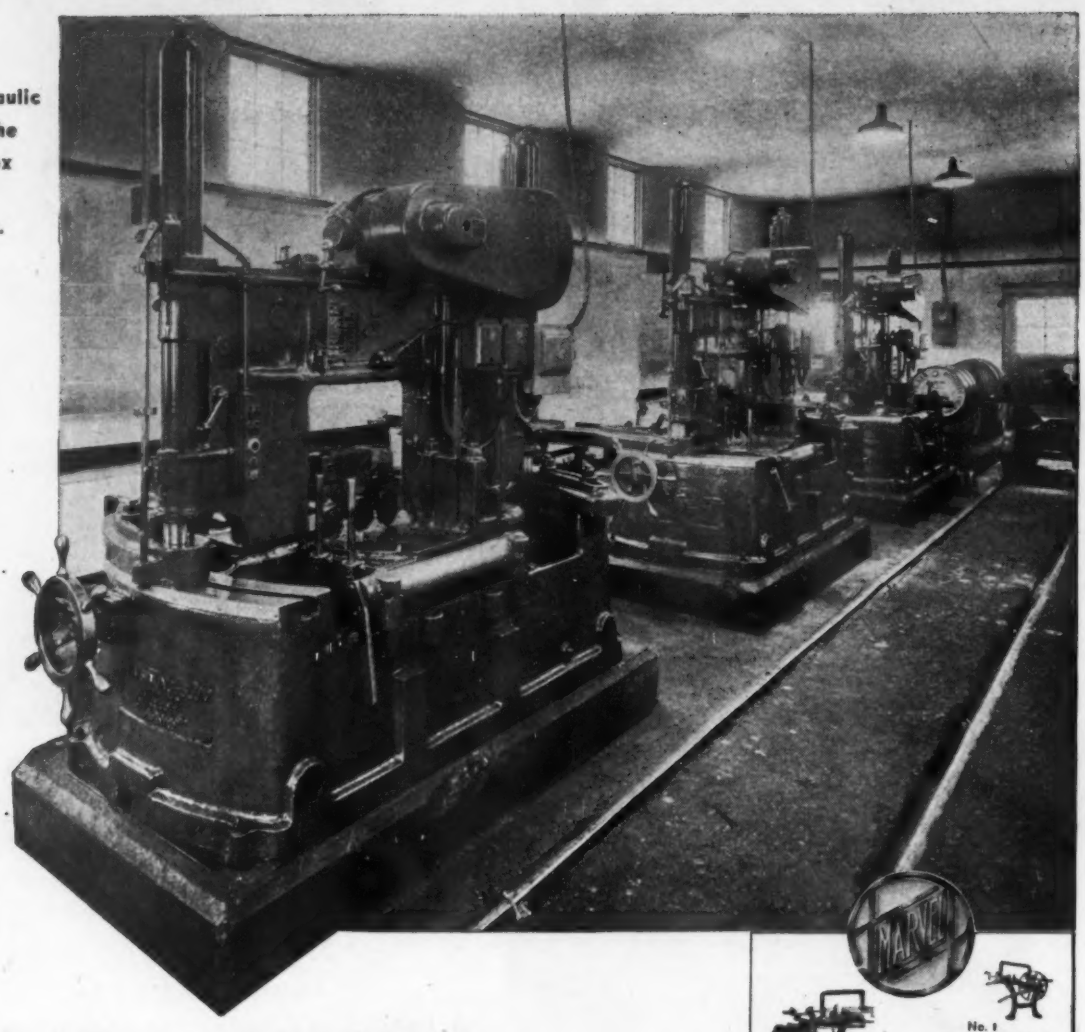
GISHOLT MACHINE COMPANY
1201 E. Washington Ave. • Madison 3, Wis.

Balancing the spindles for synthetic thread-making machine. The Gisholt 1S Dynetric Balancing Machine makes a quick and accurate job of it, eliminating unbalance that would cause undesirable vibration at the extreme end of the spindle.

Ahead . . . Keep Ahead . . . with Gisholt

RET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

3 MARVEL #18 Hydraulic Hack Saws at the Babcock & Wilcox Tube Co.— Beaver Falls, Pa.



EASILY CUT-OFF TOUGHEST STEELS

Steels just don't come too tough for MARVEL Giant Hydraulic Hack Saws. Take, for example, the three No. 18 MARVEL Saws, at the Babcock & Wilcox steel mill, shown above. These machines are used to cut test specimens from sample pieces of stainless and other tough alloy billets which are checked for seams, pipes, etc., before being drawn into tubing. It takes tough steel to make the best tubing, and it takes modern sawing equipment to cut it rapidly, accurately and economically.

With 10 types of metal-cutting saws, each available in a series of variations, MARVEL can furnish sawing machines that exactly meet your requirements. If you have a metal-sawing problem—call in the local MARVEL Sawing Engineer.

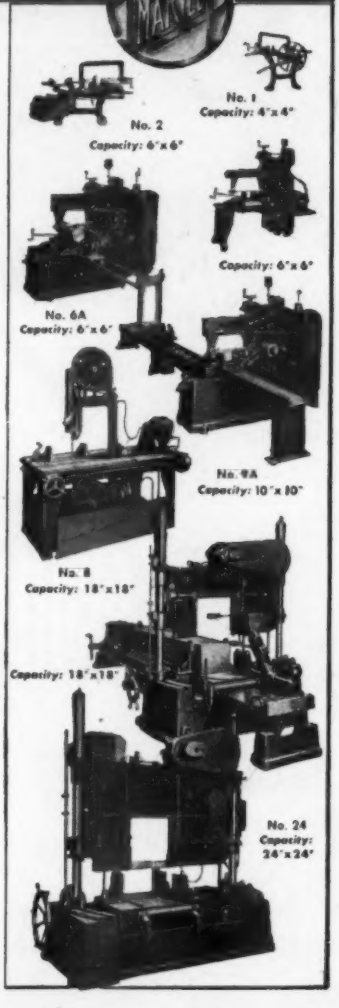
Write for MARVEL Catalog or check it in your Sweet's Catalog Files

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 BLOOMINGDALE AVENUE CHICAGO 39, U. S. A.

Eastern Sales Office: 225 LAFAYETTE ST., NEW YORK 12, N. Y.



MARVEL SAWS

NO MATTER WHAT YOUR PRODUCT MAY BE . . .

Ex-Cell-O's Complete Parts Production Facilities May Be of Practical Help to YOU!

Few people realize how extensive are Ex-Cell-O's facilities for the speedy production of quality parts. Yet the same wide experience, the engineering "know-how", and the outstanding accuracy that distinguish Ex-Cell-O machine tools and cutting tools wherever they are used . . . in many parts of the world . . . go into Ex-Cell-O's production parts manufacture.

If your product requires carefully machined parts, the chances are Ex-Cell-O can work with you to your economical advantage. Contact Ex-Cell-O today, either at the Head Office in Detroit or through any one of the 27 other leading industrial centers where Ex-Cell-O field engineering representatives are located.

Folder illustrating Ex-Cell-O's complete parts production facilities will be sent you upon request. Write or wire Ex-Cell-O today and ask for Ex-Cell-O Bulletin No. 36151.

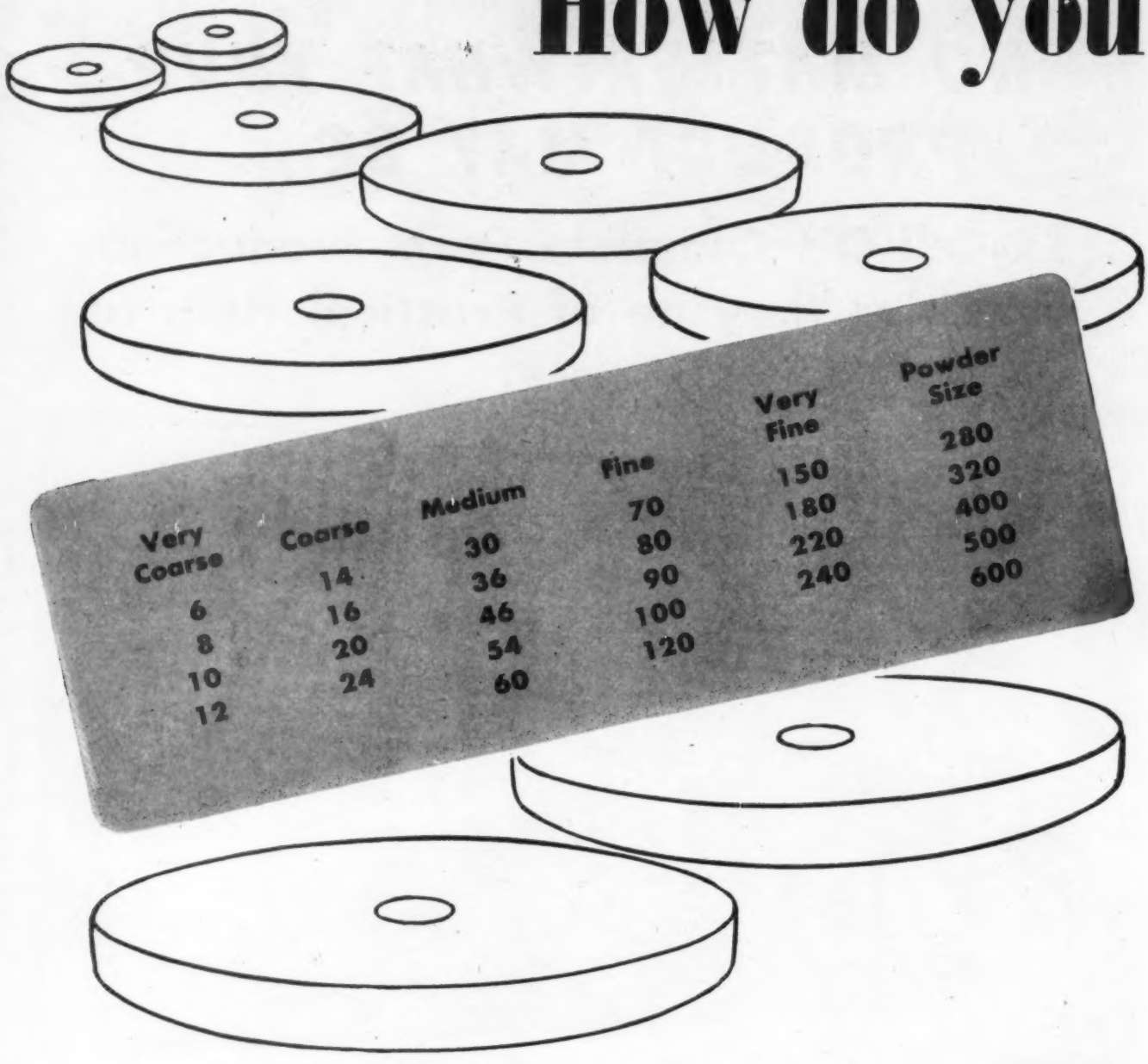
EX-CELL-O CORPORATION • DETROIT 6

XLO

EX-CELL-O *for* PRECISION

46—14

How do you



A good rule for good grinding... **CALL**

tell which grit to use?

Listed is a commercial classification of standard abrasive grit sizes. They come in a wide range... from 6 classified as very coarse to 600 classified as powder size. And, the variety is further extended by special sizes and combinations. Yet, each one is designed to do a specific job better than any of the rest.

To complicate correct choice even more, there is a long list of variable factors to consider. Among these, you'll find wheel speed, machine condition, specified tolerances, material analysis, related production schedules, and a host of others.

The correct selection hinges on the review which is given to all the controlling factors. Yet... grinding efficiency and economy depend on the right answer.

That's why The Carborundum Company has put together a practical program...a service now deemed essential by many concerns who have been successful in getting improved grinding in terms of better finishes, or at lower cost.

Your nearest contact to this effective service is a CARBORUNDUM representative. You'll find him willing and helpful. Through a sound knowledge of abrasives and first-hand experience of their use and application in the many plants he contacts, he is able to make intelligent recommendations and suggestions. On the more uncommon problems, he can even call on our Abrasive Engineers who are more fully qualified to tackle the tough problems. And, sometimes, the answer comes from the modern laboratories at CARBORUNDUM—where scientists and technicians probe for new information on abrasives, practices and developments.

Here is a sound approach—not only to getting the right grit—but the right combination of grit, bond, grade, structure and all the other parts that make up a grinding wheel. *Plus* knowledge and experience invaluable in modern grinding methods and procedures. It's easy to use. It incurs no obligation. It always makes sense. The Carborundum Company, Niagara Falls, N. Y.

IN CARBORUNDUM

TRADE | MARK

BONDED ABRASIVES

WHEELS
- Silicon Carbide
- Aluminum Oxide
- Diamond

Cylinder Hones
Sticks, Stones & Rubs
Specialties

COATED ABRASIVES

Paper, Cloth and Combination
Sheets, Rolls, Discs

ABRASIVE GRAINS AND COMPOUNDS

for:
Polishing
Lapping
Pressure Blasting
Finishing

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company

SUNDSTRAND "Engineered" Production produces 36 more pieces per hour...

New Milling Method doubles output, eliminates spoilage

CUTTING milling production costs is primarily a matter of obtaining proper methods. The proper approach to obtaining proper methods is through designing or "engineering" the most profitable processing method, then obtaining machines to suit this method—standard or semi-standard machines, if possible, or entirely special machines, if necessary.

This approach is what we call Sundstrand "Engineered" production, and here's how it's been successfully applied in one plant while using *standard* Sundstrand milling equipment.

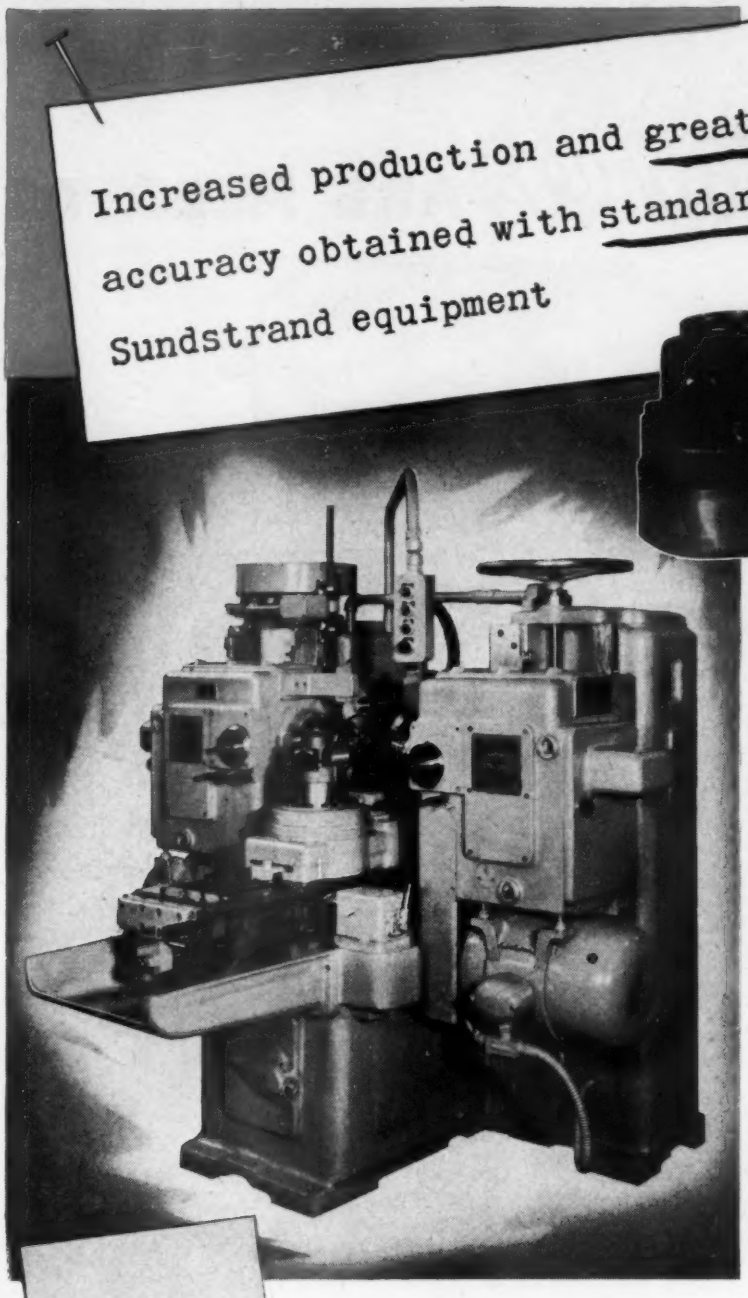
HERE'S WHAT YOU CAN EXPECT FROM SUNDSTRAND "ENGINEERED" PRODUCTION...

A careful analysis of your present milling methods will be made by one of our engineers without obligation. He will study these methods with a view toward lowering your milling costs with either new methods and new equipment, or new methods with present equipment. Write for this service at any time.

SUNDSTRAND MACHINE TOOL CO. ROCKFORD, ILLINOIS, U.S.A.

RIGIDMILLS | FLUID-SCREW RIGIDMILLS | AUTOMATIC LATHES | HYDRAULIC EQUIPMENT

Increased production and greater accuracy obtained with standard Sundstrand equipment



FOUR surfaces of the cast iron compression block shown are milled on a standard model 22 Sundstrand Rigidmil. This machine is of the duplex type and provided with a Sundstrand standard automatic index base attachment. In using the duplex type machine and providing an automatic indexing cycle all four sides are machined in two passes of the table and one handling of the part. This results in greater accuracy and eliminates spoilage.

The left hand head of the machine is equipped with a standard vertical feed attachment which automatically positions the cutter to correct height for milling highest pad.

Production of this machine is more than double that of the unit replaced. It produces 67 pieces per hour at 85% of efficiency. The old milling setup turned out 30.5 pieces per hour.

MORE FREE MILLING PRODUCTION FACTS

You'll find plenty of milling methods in this book . . . methods that may provide a short cut or profitable solution to similar jobs in your shop now. Tooling diagrams and machine designs are both included. Write for your copy today. Ask for bulletin No. 154.

SUNDSTRAND MACHINE TOOL COMPANY

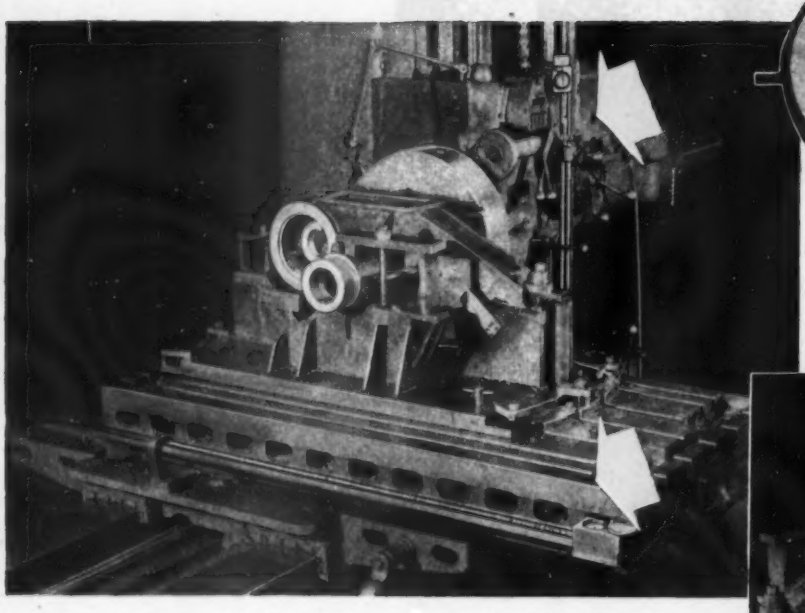
2533 Eleventh St. • Rockford, Ill., U.S.A.

DRILLING AND CENTERING MACHINES | **SPECIAL MILLING AND TURNING MACHINES**

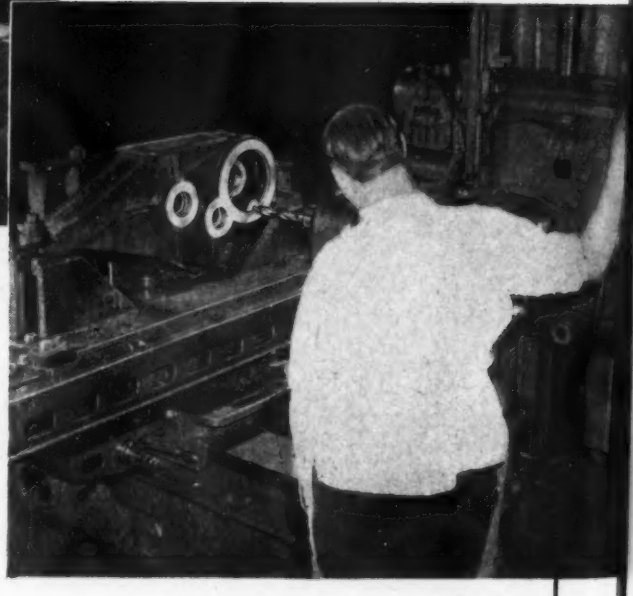
HOW Center distances ARE HELD TO

Photographs Courtesy Holm's Manufacturing Co., Kenosha, Wis.

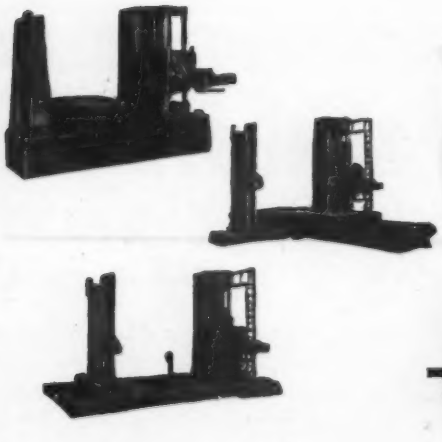
Gear case finish machined.

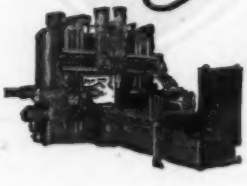


Precision end measures and dial indicators on the machine table and headstock are shown here. Center distances of the gear case trunnion have been determined and the end measures speed bore location.



Welded steel gear case being drilled after rough boring and facing operations. Machine spindle extends through the Continuous Feed Facing Head to drill this hole.





G&L Giddings

±.0004" ON A Standard G. & L.!

Machine Equipped with Dial Indicators and Precision End Measures *Eliminates* Work Layout and *Speeds Accurate Duplication of Machining Operations*

Bore center distances on this welded steel gear case are readily held to ± .0004" limits. The built-in accuracy of a standard Giddings & Lewis Horizontal Boring, Drilling and Milling Machine equipped with precision end measures and dial indicators makes it possible to hold this close tolerance.

End measures are laid in a V-type trough on the rear side of the machine table and are brought to register between a positive stop secured to the machine saddle and a dial indicator registering to .0001". After the end measures are adjusted to locate the correct center distances between bores, this adjustment is used for each successive part. Repetitive boring can be readily made and the same precision limits accurately held.

Precision Boring, Counterboring, Drilling, Turning and Facing Operations Performed in a Single Work Setting

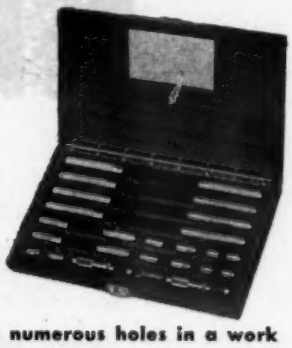
Gear case production is further speeded by completing several different operations in one setting of the work. A Continuous Feed Facing Head is used to face the various bores and to turn the integral gear case trunnion. Performing these several operations in a single work setting on a G. & L. machine makes it unnecessary to move the part to other machines for individual operations.

When Your Machining Must Meet Accuracy Limits Equivalent To a Jig Borer

Precision machining to tolerances equal to those ordinarily obtained on a jig borer is possible with a Giddings & Lewis Horizontal Boring Machine when it is equipped with end measures and dial indicators. In addition, operations need not be limited to boring alone for the flexible G. & L. will BACK BORE, COUNTERBORE, TURN, FACE, DRILL, TAP, MILL and REAM on all types, sizes and shapes of work. Giddings & Lewis engineers are available to assist you in solving your precision machining problems — merely outline your needs — there is no obligation.

PRECISION END MEASURES . . .

Purpose and Applications



- To eliminate layout and simplify work set-up
- To insure more accurate work settings in shorter time
- To eliminate the use of toolmakers' buttons and other similar measuring devices
- To make accurate duplication of machining operations possible.
- For use in drilling and boring numerous holes in a work piece where center distances and alignments must be held
- For use when jig boring operations are performed on the horizontal boring machine

PERFORMANCE DATA AVAILABLE

FREE

Covering actual field cases showing G. & L. machines and attachments in use. Ask for Production Data Folder A.M. 116.

G & L Lewis MACHINE TOOL CO.

138 DOTY STREET • FOND DU LAC, WISCONSIN

THIS HEAD FOR MULTIPLE PRECISION GRINDING *Cuts* PRODUCTION COSTS

Mass production can be applied to precision grinding only with equipment whose design incorporates simple, automatic precision controls. The Fitchburg method works on a new principle, far superior to other methods.

"Brain center" of multiple precision grinding, the Fitchburg Bowgage Head is a completely self-contained and independent grinding unit. It can be installed *singly* on standard equipment in any position and at any angle 0° to 90°, or in multiples to operate simultaneously or consecutively in mass production.

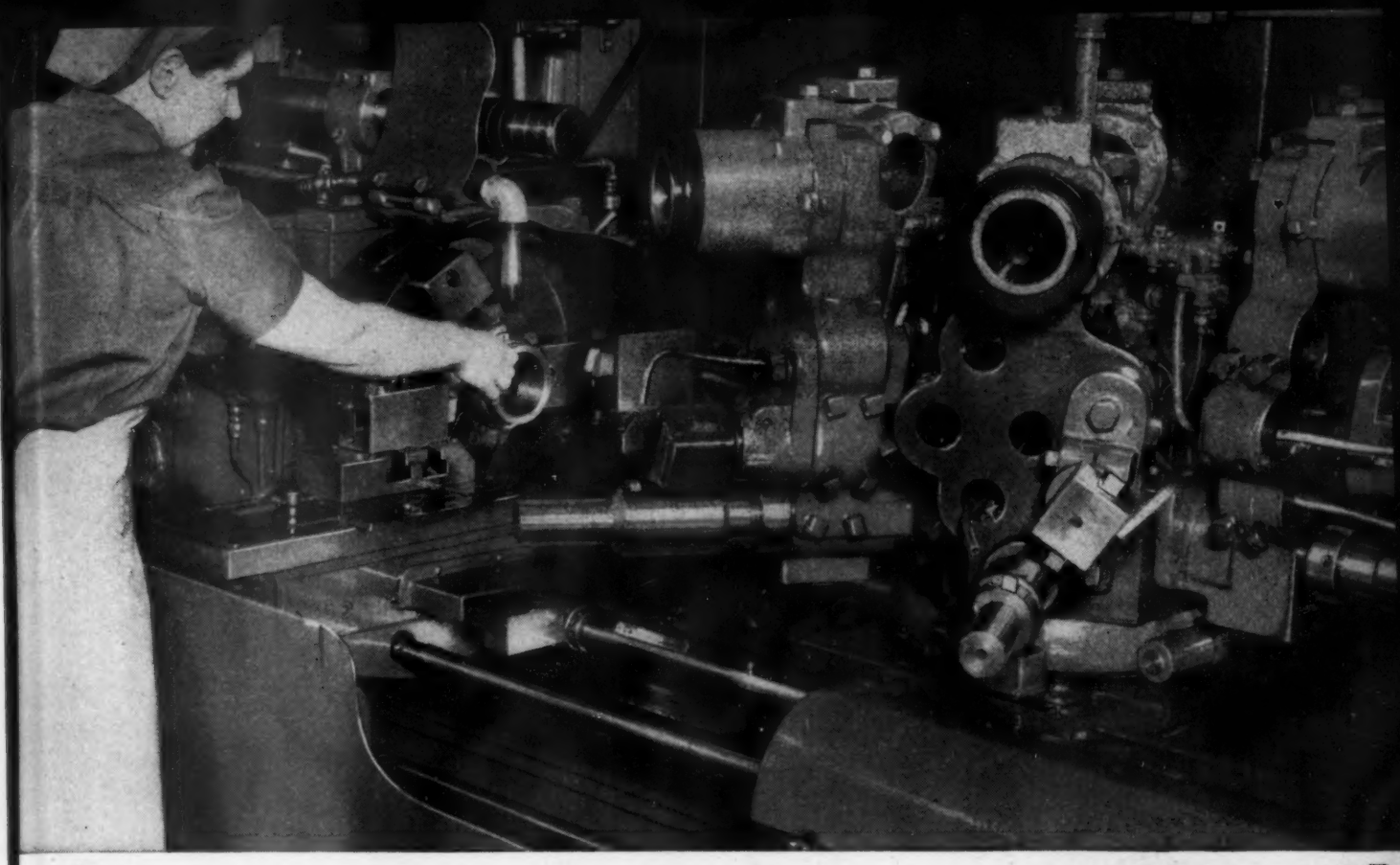
Fitchburg design gives greater accuracy, finer finish, speedier operation, at less cost per piece. See *how* Fitchburg Bowgage heads, standard and interchangeable, save your investment for the reconversion period. Write today for information on how its cut-cost features can be applied to the precision grinding jobs in your plant.

THE HEAD. *The Bowgage Head* is a completely independent precision grinding unit. It has rapid traverse, slow grinding feed, grinding dwell or spark out, and rapid return to starting position — all started by one push button. It is precise to .0002", minimizing spoilage. It can be removed and remounted for other work, if operations are changed.

THE BODY. *This Special Fitchburg Double-Head Machine* grinds track roller shafts for caterpillar-type tractors. Two grinding wheels plunge-cut the diameter, after which both wheels travel toward each other to grind the shoulder of the shaft — *all in one set-up — with standard Bowgage Heads.*

Write Today for Catalog—Sent Free Upon Request

FITCHBURG GRINDING MACHINE CORP.
FITCHBURG, MASSACHUSETTS, U.S.A.
Manufacturers of—Bowgage Wheelhead Units, Multiple Precision Grinding Units, Spline Grinders, Cylindrical Grinders, Gear Grinders, Both Full Universal Grinders and Special Purpose Grinders



THREE PARTS PER TURRET CYCLE

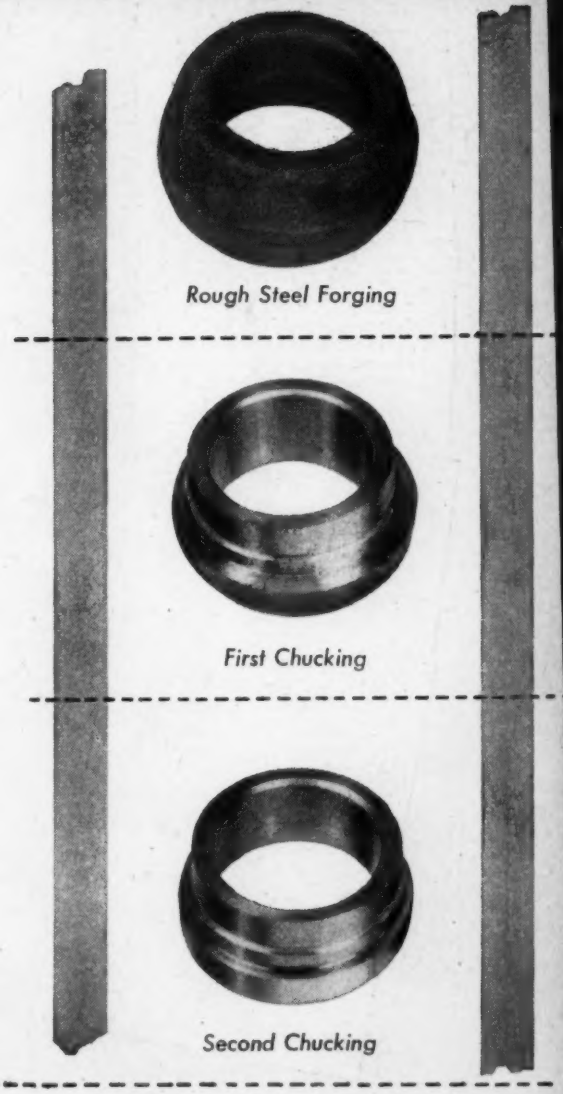
with Triplicate Tooling

on the FASTERMATIC

Here's another way the adaptability of the Fastermatic can be used to advantage even on comparatively simple jobs.

To complete the turning of drive gears in two chuckings, two Fastermatics are used—one for each chucking. The turret of each machine is set up with three identical sets of tools so that a piece is both rough and finish turned with every second indexing. There is no skip indexing to waste production time. And still more production time is saved by the independent operation of the cross slides.

Whether it's high or low production machining, whether it's a few or a large number of operations per chucking, the Fastermatic provides a degree of flexibility that brings lower costs on a wide variety of work. With its automatic machining cycle, there is nothing for the operator to do but load and remove the work. Write for literature.

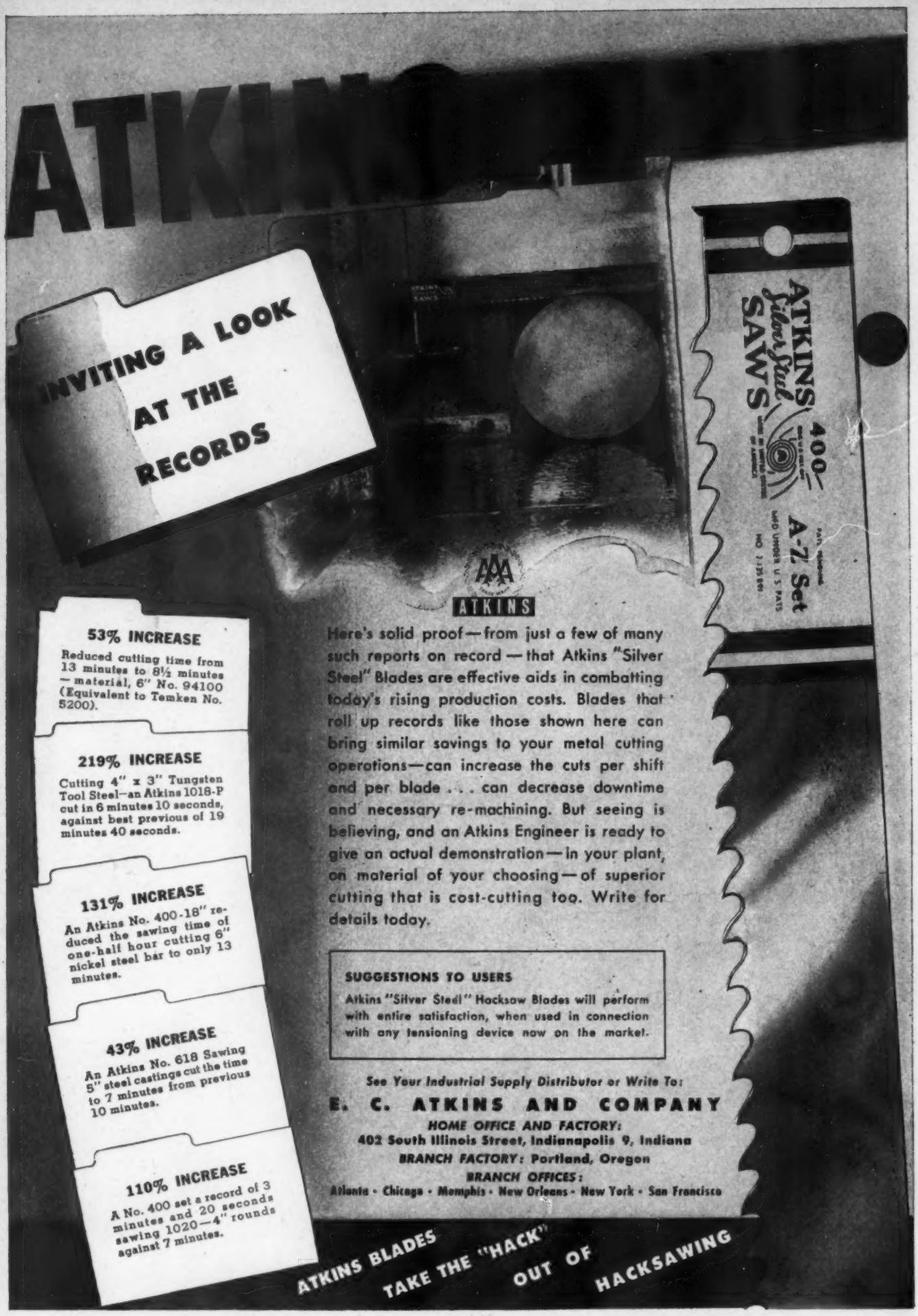


GISHOLT MACHINE COMPANY

1201 East Washington Ave. • Madison 3, Wis.

Look Ahead . . . Keep Ahead . . . with Gisholt

URRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



53% INCREASE

Reduced cutting time from 13 minutes to 8½ minutes — material, 6" No. 94100 (Equivalent to Temken No. 5200).

219% INCREASE

Cutting 4" x 3" Tungsten Tool Steel—an Atkins 1018-P cut in 6 minutes 10 seconds, against best previous of 19 minutes 40 seconds.

131% INCREASE

An Atkins No. 400-18" reduced the sawing time of one-half hour cutting 6" nickel steel bar to only 13 minutes.

43% INCREASE

An Atkins No. 618 Sawing 5" steel castings cut the time to 7 minutes from previous 10 minutes.

110% INCREASE

A No. 400 set a record of 3 minutes and 20 seconds sawing 1020—4" rounds against 7 minutes.

Here's solid proof—from just a few of many such reports on record—that Atkins "Silver Steel" Blades are effective aids in combatting today's rising production costs. Blades that roll up records like those shown here can bring similar savings to your metal cutting operations—can increase the cuts per shift and per blade . . . can decrease downtime and necessary re-machining. But seeing is believing, and an Atkins Engineer is ready to give an actual demonstration—in your plant, on material of your choosing—of superior cutting that is cost-cutting too. Write for details today.

SUGGESTIONS TO USERS

Atkins "Silver Steel" Hacksaw Blades will perform with entire satisfaction, when used in connection with any tensioning device now on the market.

See Your Industrial Supply Distributor or Write To:

E. C. ATKINS AND COMPANY

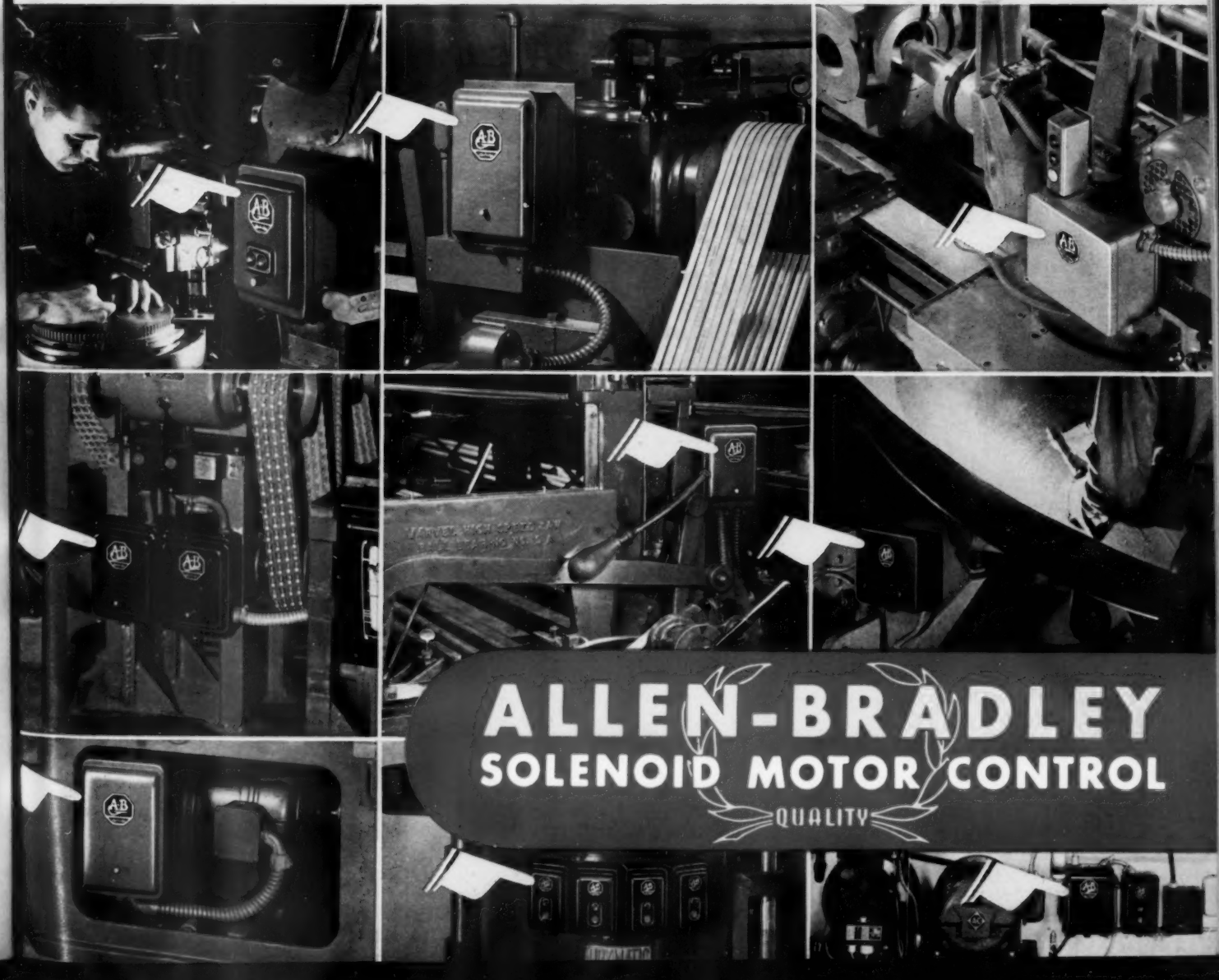
HOME OFFICE AND FACTORY:
402 South Illinois Street, Indianapolis 9, Indiana
BRANCH FACTORY: Portland, Oregon
BRANCH OFFICES:
Atlanta • Chicago • Memphis • New Orleans • New York • San Francisco

ATKINS BLADES TAKE THE "HACK" OUT OF HACKSAWING

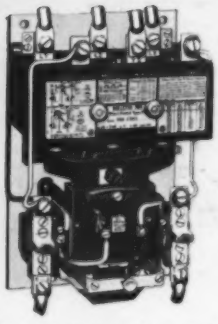
A-B Quality

This Nameplate on Your Machines

...a sure sign of QUALITY motor control



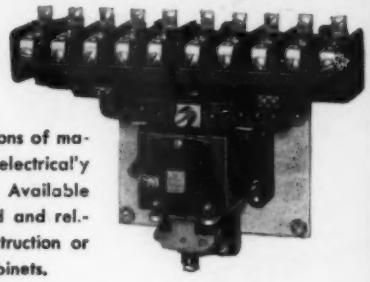
Trouble-Free
SOLENOID CONTROL UNITS
For Your Special Control Panels



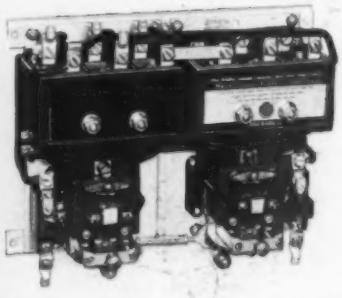
Bulletin 709 ACROSS-THE-LINE STARTERS

Designed for across-the-line starting of polyphase squirrel cage motors. Two thermal overload relays protect the motor from damage due to sustained overloads. Good for millions of trouble-free operations.

Bulletin 702 SOLENOID CONTACTORS



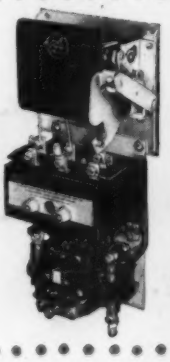
For controlling the various motions of machine tools and in all kinds of electrically operated mechanical equipment. Available in from one to ten poles. Rugged and reliable. Provided in the open construction or with several types of enclosing cabinets.



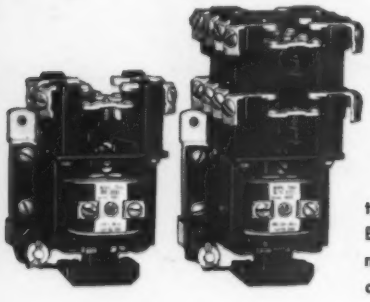
Bulletin 705 REVERSING SWITCHES

For automatically starting and reversing two- and three-phase squirrel cage and certain single-phase motors. Simple, reliable, mechanical contactor interlock.

Bulletin 712 DISCONNECT SWITCH TYPE COMBINATION STARTERS



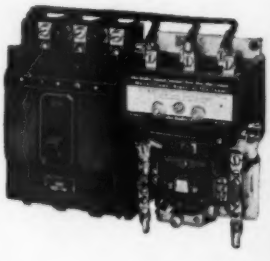
A manual disconnect switch also provided with silver alloy contacts and a solenoid type across-the-line starter mounted on a common base plate. These starters offer greater safety, require less space, and cost less to install than a separate starter and disconnect switch. Results in a more attractive job.



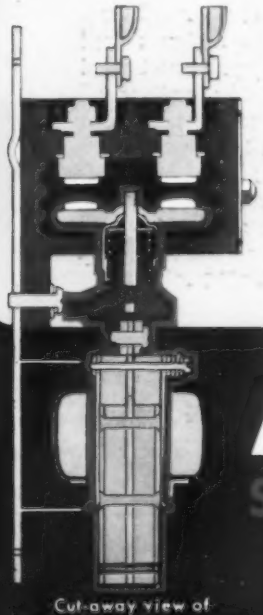
Bulletin 700 SOLENOID RELAYS

Small and inexpensive, but extremely rugged and trouble-free. Built with from one to 12 poles in many different types. Remarkably consistent in operating speed.

Bulletin 713 CIRCUIT BREAKER TYPE COMBINATION STARTERS



Consist of a solenoid type across-the-line starter and a magnetic trip ITE circuit breaker for short circuit protection. Furnished in the open construction or with several types of enclosures.



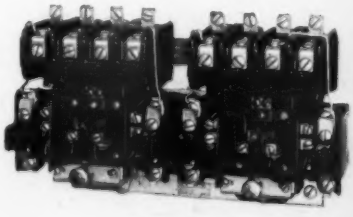
Cut-away view of Allen-Bradley solenoid starter.

Only ONE MOVING PART in these Solenoid Starters

All of the controls listed on this page utilize the simple and trouble-free Allen-Bradley solenoid mechanism. They have no hinges, pivots, or bearings to cause variations in time of operation. All have double break, silver alloy contacts that require no maintenance. Write for information.

ALLEN-BRADLEY COMPANY
1316 S. Second St., Milwaukee 4, Wis.

Bulletin 715 MULTI-SPEED STARTERS



Designed for the remote control of 2, 3, and 4 speed squirrel cage motors of either the consequent pole or separate winding types. Consist of two or more magnetic contactors, each equipped with two thermal overload relays.

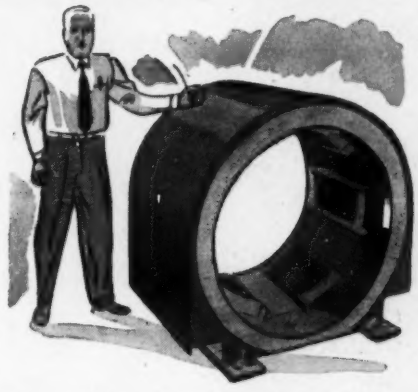
ALLEN-BRADLEY
SOLENOID MOTOR CONTROL
QUALITY

A-B Quality

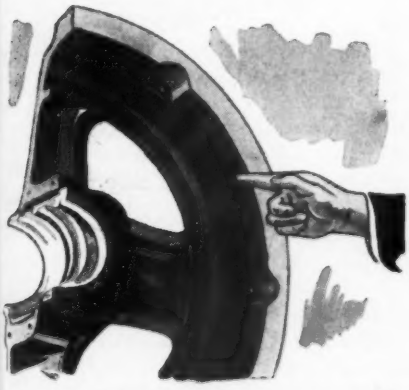
"You Never Saw Such Trouble-free Motors..."

Which Is Another Way of saying they *stand up better* than any other make we've used on this job!" Strong words, but they describe exactly how this customer feels about the 500-hp, open type, bracket bearing Allis-Chalmers motors he started using back in '35.

Since Then He's Ordered 14 *identical* motors for mine pump service! Yes, in almost every industry you'll find these 250 hp and up, medium and high-speed motors paying their way on toughest drives. A check into several of their unusual features will reveal *why*.



Take Yokes, for example. *Steel,* not cast iron. Result: they've got more strength, feet won't break off, there are no projections inside or out to catch dirt. Furthermore, yokes are solid . . . have no openings to admit dust or dirt during non-operating periods.



And Bearing Brackets are *extra*-deep . . . giving greater protection to stator winding coil ends. They're oil leak-proof too. Further, these motors are quiet in operation. Liberal air paths keep air velocities low. Enclosed type yokes reduce noise. Magnetic noise is kept to a minimum. *Yes, from every angle, A-C builds quality into motors!*

"A-C" Means Quality — Clear Through!

SMALL OR LARGE, in a range of 1 to 7,000 hp, you're *sure* of top quality when you specify Allis-Chalmers motors!

Check their rigid, distortionless stators . . . their tough insulation specially treated to resist deterioration, moisture and mild acids . . . their long-life rotors . . . their rigid frames that keep bearings protected and in perfect alignment.

For the *full* story of liberal Allis-Chalmers construction, get in touch with your nearby A-C dealer or sales office. ALLIS-CHALMERS, MILWAUKEE 1, WIS.

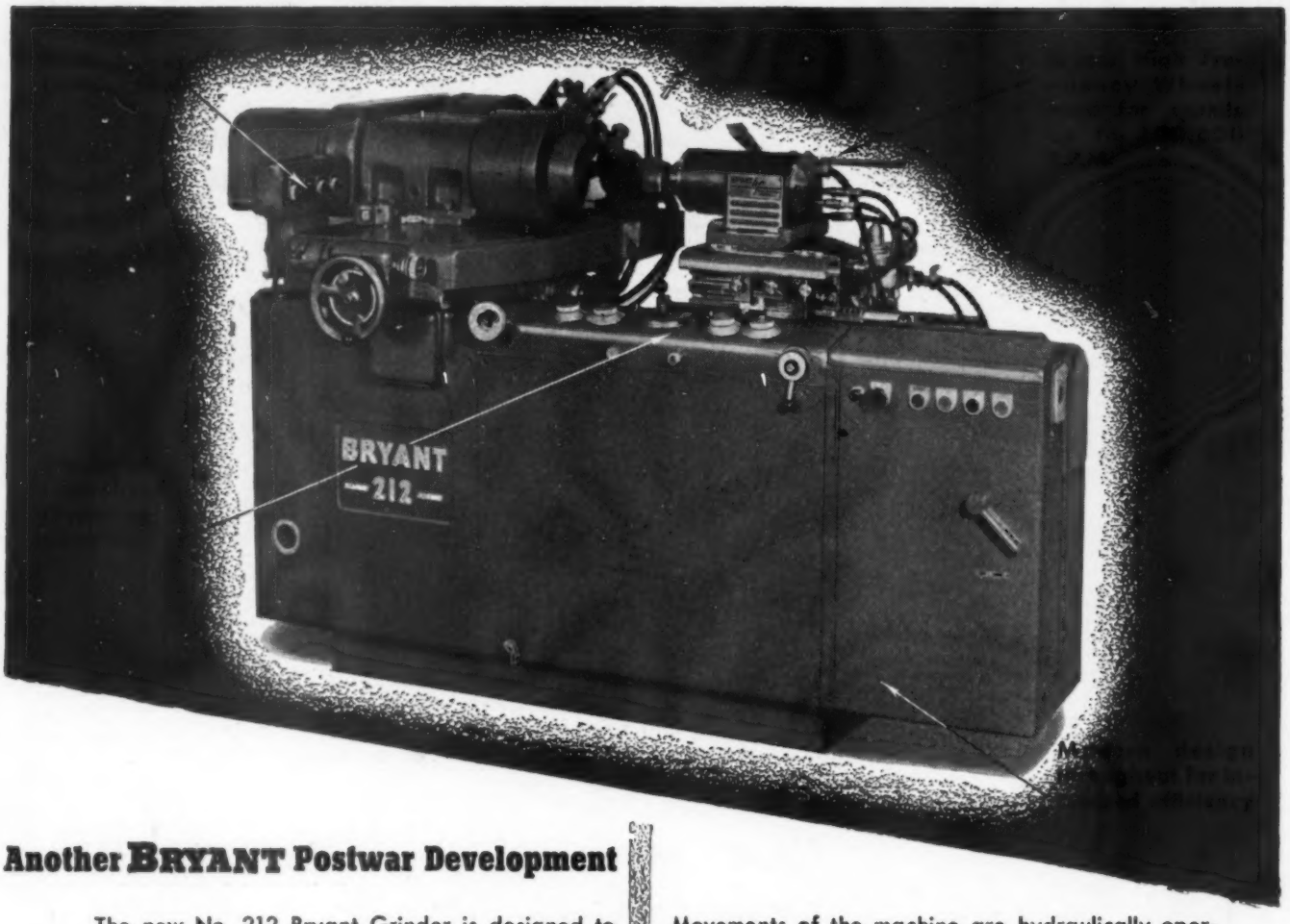
ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

A 2118

Announcing a New Automatic High Production Internal Grinder

No. 212



Another BRYANT Postwar Development

The new No. 212 Bryant Grinder is designed to fill the pressing need for greater production per man hour. It is a fully *automatic* internal grinder that requires a minimum of operator attention—in fact on many jobs one man can run two machines. Production is higher, more precise and more profitable with this new grinder.

The new No. 212 Bryant roughs and finishes bores from 5/16" to 6" (approx.) in diameter in lengths up to 3 inches. On the smaller bores, it is especially suited to the use of *Bryant High Frequency wheel spindles which operate at speeds up to 100,000 r.p.m.*

The No. 212 design incorporates the superiority of Bryant three point wheel slide suspension and insures maximum rigidity under all conditions. Movements of the machine are hydraulically operated, while the cycle is controlled electrically to facilitate change-over. Sizing is accomplished accurately and automatically by any one of three methods: a plug gage mounted in the work spindle, a diamond tipped bore contact, or controlled by the wheel truing diamond. It *roughs* and *trues* and *finishes* and stops *automatically*—producing parts with fine work finish to tolerances that insure bores that are straight and round, making the products which you manufacture more desirable because they run smoother and live longer.

If grinding figures in your production plan, your move for best results is to—

SEND For The Man From Bryant.

BRYANT

BRYANT CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U. S. A.

Always Specify

CLE-FORGE HIGH SPEED DRILLS

*TRADE MARK REG. U.S. PAT. OFF.

. . . FOR FAST, DEPENDABLE PRODUCTION DRILLING AND MORE HOLES PER GRIND

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INDUSTRIAL SUPPLY DISTRIBUTOR

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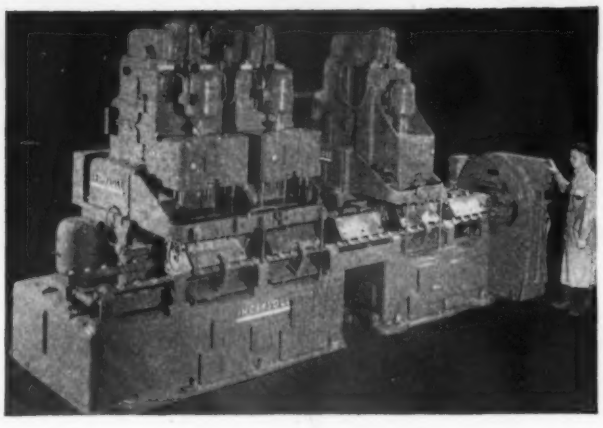
2029 EAST GRAND BLVD., DETROIT 2 • 1902 NORTH FIELD ST., DALLAS 1
E. P. BARRUS, LTD., LONDON W. 1, ENGLAND

INGER

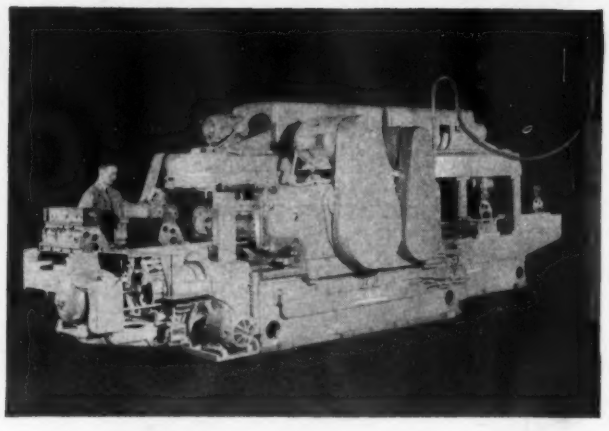
Four Ways



4-Station Process Machine for milling, drilling and reaming at 150 cylinder blocks per hour.

•

Ingersoll Process Machines are designed to cut costs Multi-operations are performed by a single machine and a single operator. The operator positions the casting at the loading station. The machine does the rest.



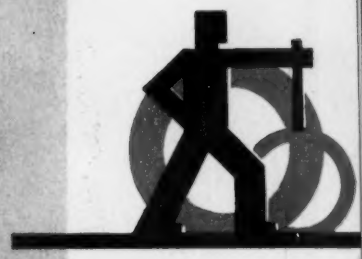
5-Station Process Machine for rough and finish milling ends at 49 cylinder blocks per hour.

•

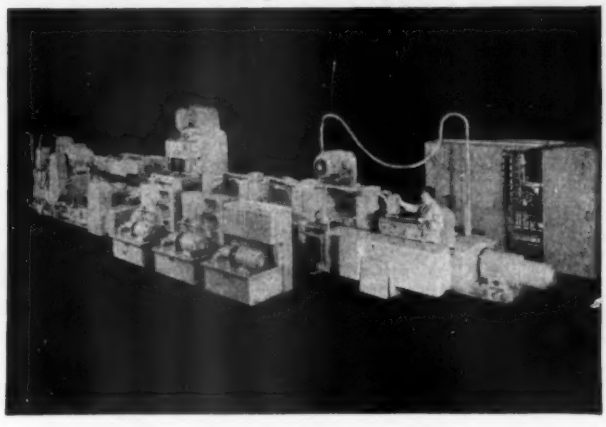
One of the secrets of the success of Ingersoll Process Machines lies in the ingenious automatic work-holding and turn over fixtures, connected by transfer mechanisms, to move the casting from station to station.

THE INGERSOLL MILLING

RSOLL



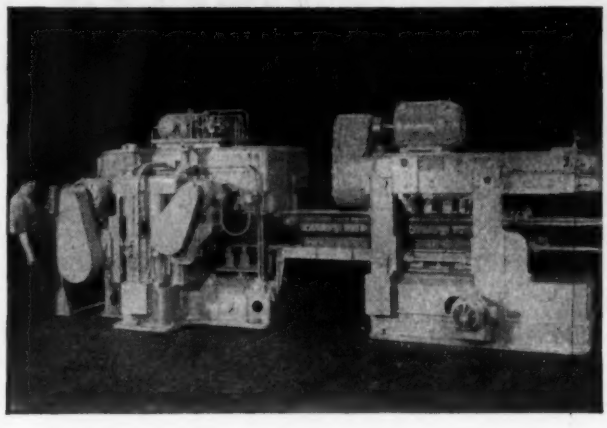
to Cut Costs...



8-Station Process Machine for milling major faces and drilling and reaming dowel holes at 43 cylinder blocks per hour.

•

To obtain the highest cutting efficiency, all of these machines are equipped with Ingersoll tungsten carbide Cutters. This permits feed rates, in some cases, double those used on older type machines.



4-Station Process Machine for boring crank and cam holes, and milling side pads at 90 cylinder blocks per hour.

•

Each of these Process Machines, including fixtures and cutting tools, was engineered by Ingersoll, who assumed full responsibility by guaranteeing production and accuracy. This experience is available to you upon request

MACHINE CO., ROCKFORD, ILLINOIS

This part called for Precision Reaming
.0001
THE PROBLEM: Ream ends of shaft housing (cut-away view above) to two diameters—holding a tolerance of .0005". Two diameters must be perfect in alignment and concentricity.
STAPLES Special Design
CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS
CEMENTED CARBIDES
Solve Difficult Production Problems

This Staples special design step reamer proved the economical solution to the precision reaming problem shown above. Reaming operation was done in turret lathe. To obtain the perfect concentricity and alignment required, the rear section of the tool has a specially modified 90° end sharpening—this causes tool to cut with end milling action, thereby correcting misalignment between the two diameters present after drilling.

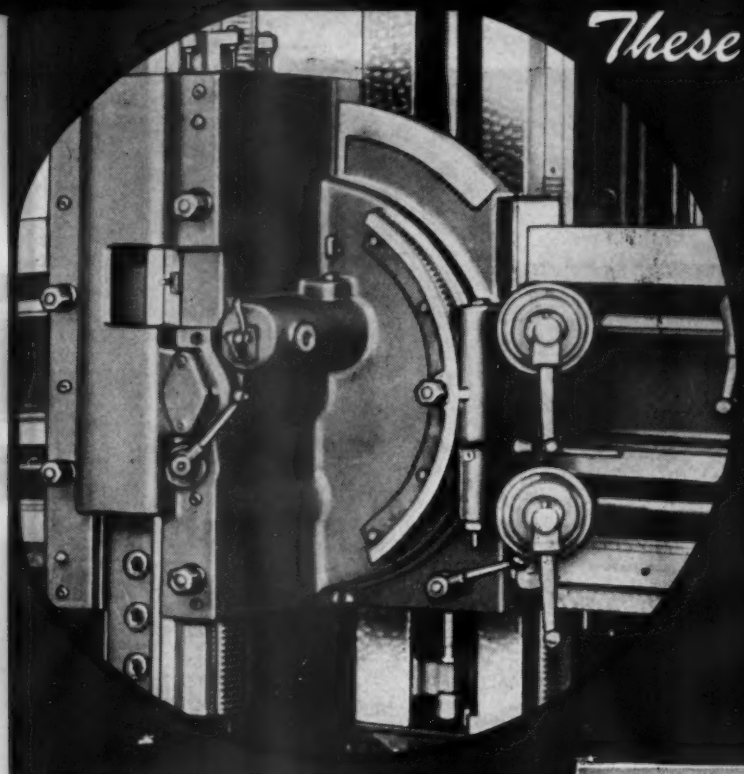
In the production of these shaft housings, this Staples reamer combined both reaming operations—maintained perfect concentricity between diameters—held consistently to the close tolerances specified—and produced an excellent finish in the hole.

Staples *Special* and *Standard* tools provide the answer to economical hole production. If your production involves special tool designs, submit your specifications and part prints to Staples Tool Engineers—we welcome the opportunity to assist you to obtain maximum efficiency in precision hole production.

THE STAPLES TOOL COMPANY
CINCINNATI 25 OHIO

Staples CARBOLOY-TIPPED CIRCULAR CUTTING TOOLS

REAMERS • CORE DRILLS • SPOT FACERS • COUNTERBORES
END MILLS • SHELL END MILLS • DISTRIBUTORS IN MAJOR CITIES



These hand adjustment levers move with the head

ON THE NEW KING

Vertical Boring and Turning Machine

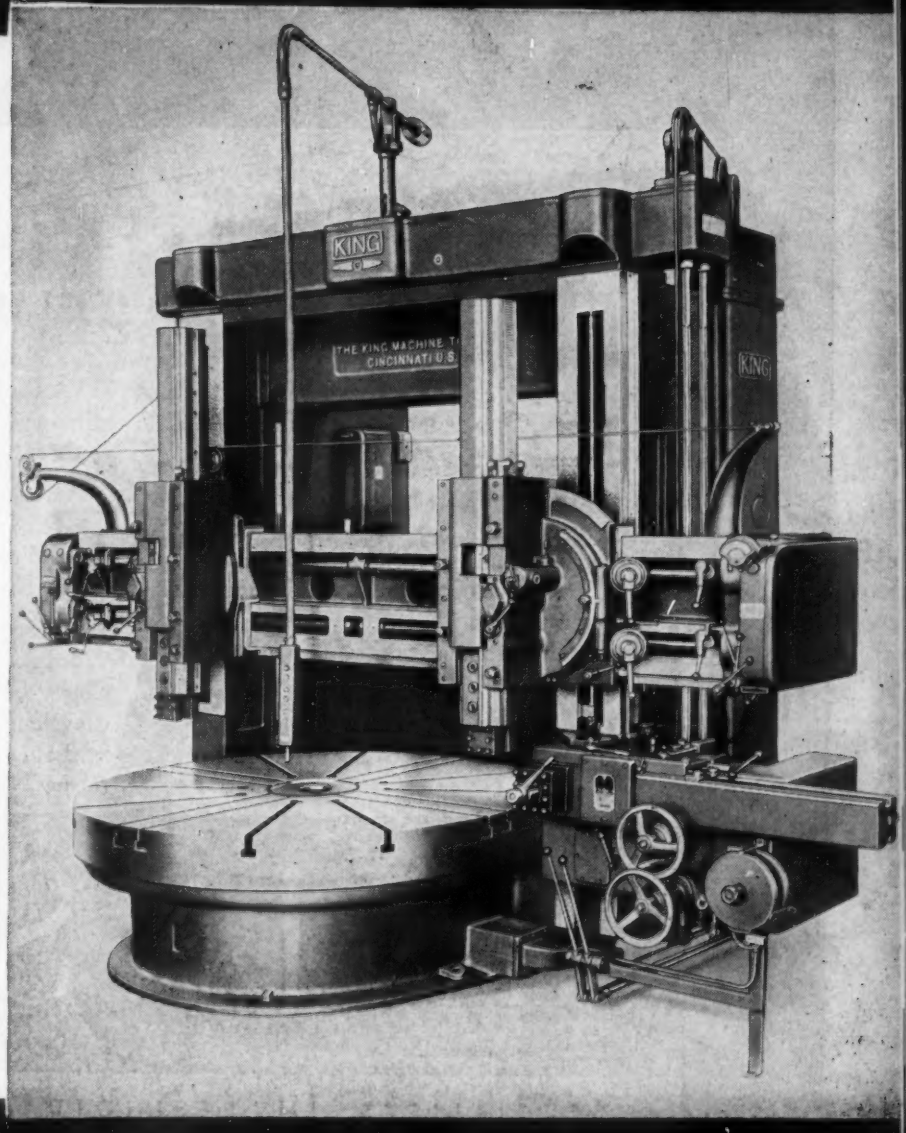
● One of the most appealing features of the new series King Vertical Boring and Turning Machine is the convenient arrangement for hand adjustment of the heads.

Horizontal and vertical hand adjustments are made easily and quickly right from the operator's work position. The control levers, being built right in the head, travel toward the work with the head and are within convenient reach at all times.

Note the heavy proportions of the heads. Accurate and rigid, they get the most out of modern carbide cutting tools.

Complete accessibility of all controls—a noticeable increase in weight—new powerful ram heads—a wide range of feeds and speeds—are but a few of its many improvements. Your boring, turning and facing operations can be done at consistently low costs on the New Series King Vertical Boring and Turning Machines.

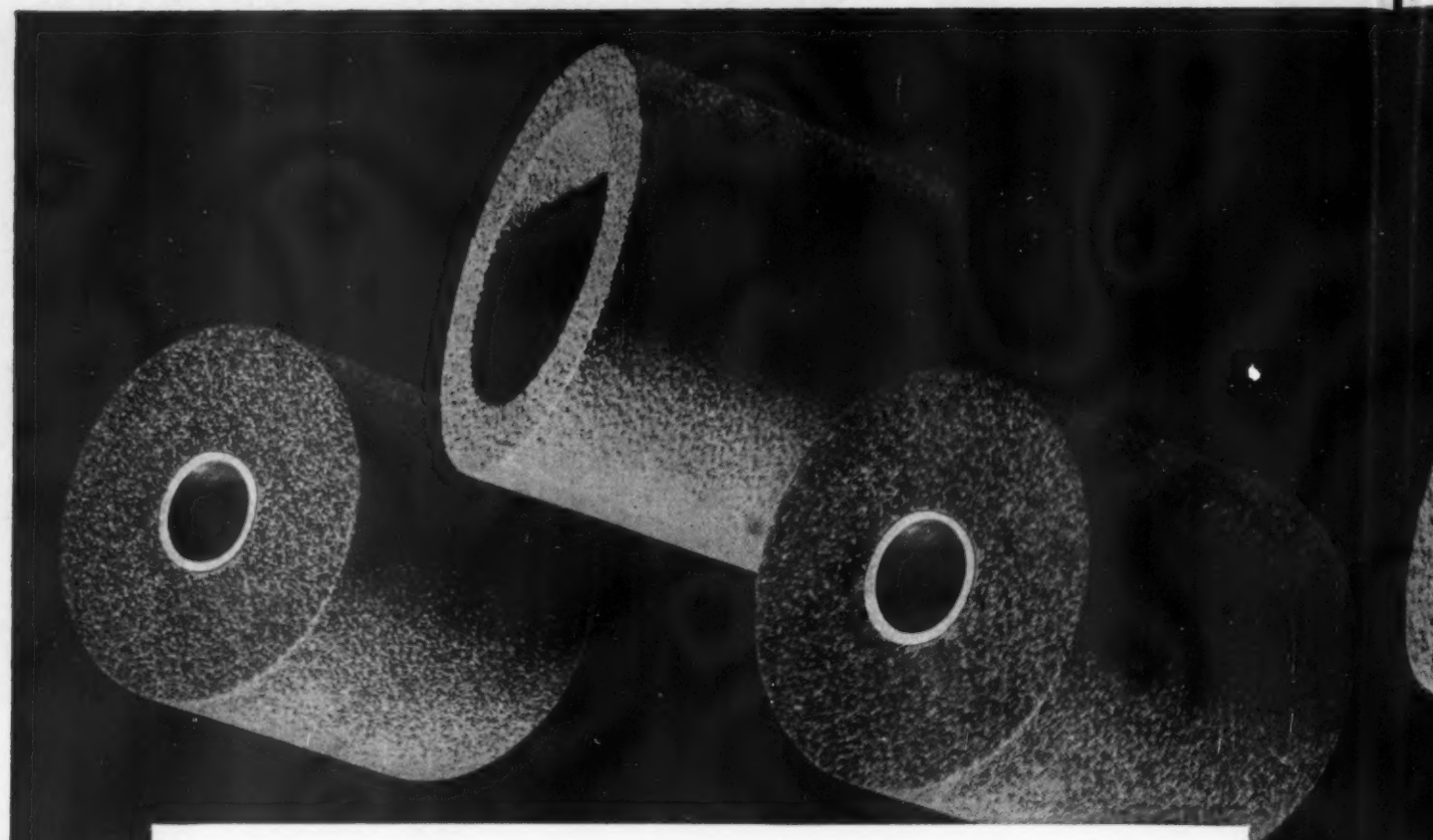
Available in ten sizes—Single Column Type 30", 36", 42". Double Column Type 52", 62", 72", 84", 100", 120", 144".



THE KING MACHINE TOOL COMPANY

CINCINNATI 29, OHIO

BUILDERS OF VERTICAL BORING AND TURNING MACHINES EXCLUSIVELY



Got 24 seconds to consider grinding?

Would you care to say right now that it is impossible to reduce your grinding costs?

If for any reason you doubt you could make that statement stick, we suggest a complete analysis of your grinding operations. Top production speed and low costs occur only when you use the correct wheels and machines for your particular work.

Call in Peninsular engineers. They will completely study your machines, your grinding methods, the metals you grind. From their findings, they will develop grinding wheels that get the kind of results you want.

Peninsular job-designed wheels can save money for you. *Every* Peninsular grinding wheel is specially made for its particular job.

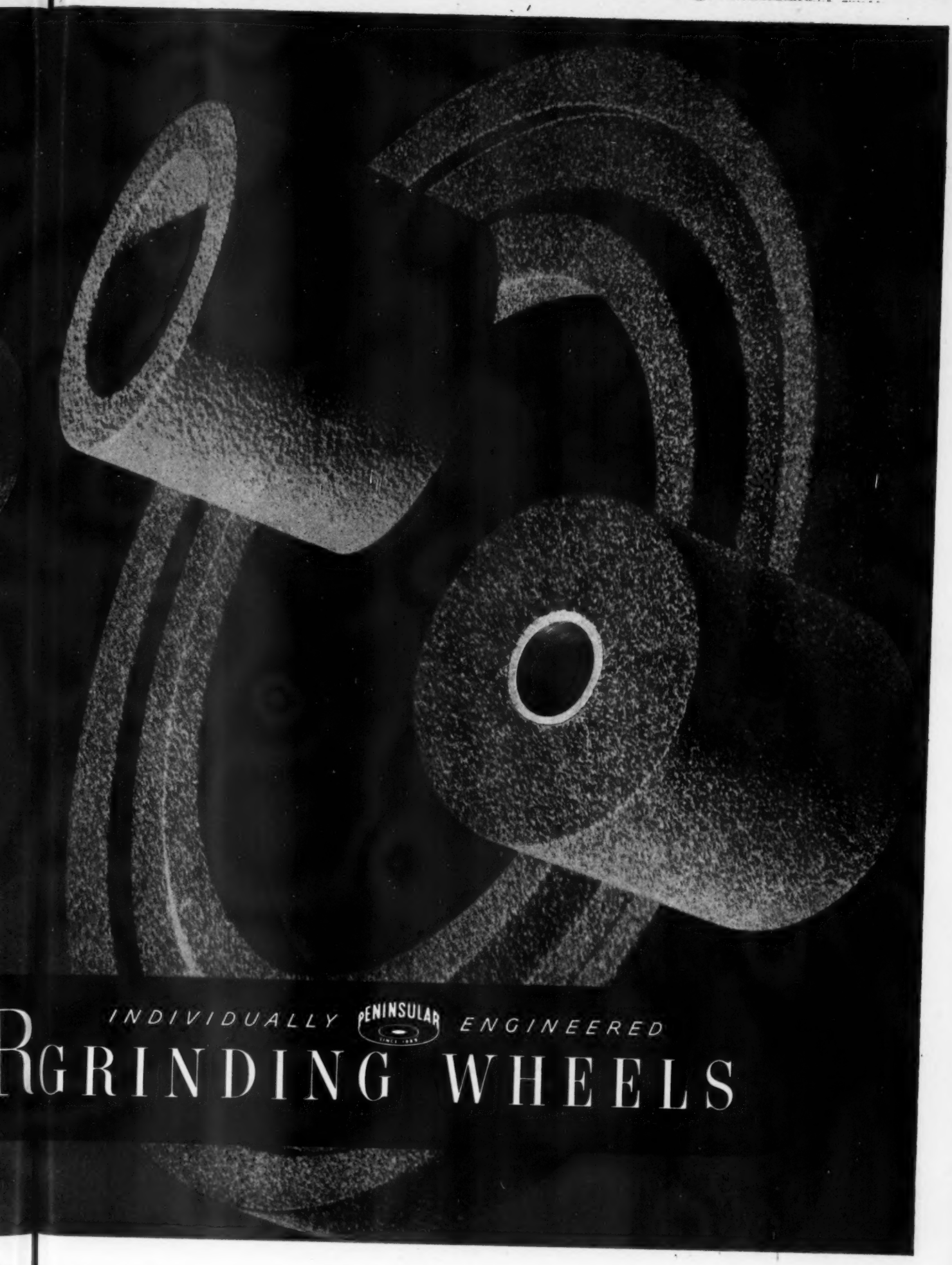
The Peninsular Grinding Wheel Co., 729 Meldrum Ave., Detroit 7. *Sales Offices:* Chicago, Philadelphia, Boston, Buffalo, Cleveland, Newark, Pittsburgh, Houston, St. Louis, Cincinnati.

(End of 24 seconds reading time.)

PENINSULAR GRINDING WHEELS

SINCE 1889

SPECIALISTS IN RESINOID BONDED WHEELS


INDIVIDUALLY PENINSULAR ENGINEERED
RGRINDING WHEELS

ACME TURRET LATHES MAINTAIN *Exceptional*

★ ACCURACY
HIGH SPEED
LOW COST ★

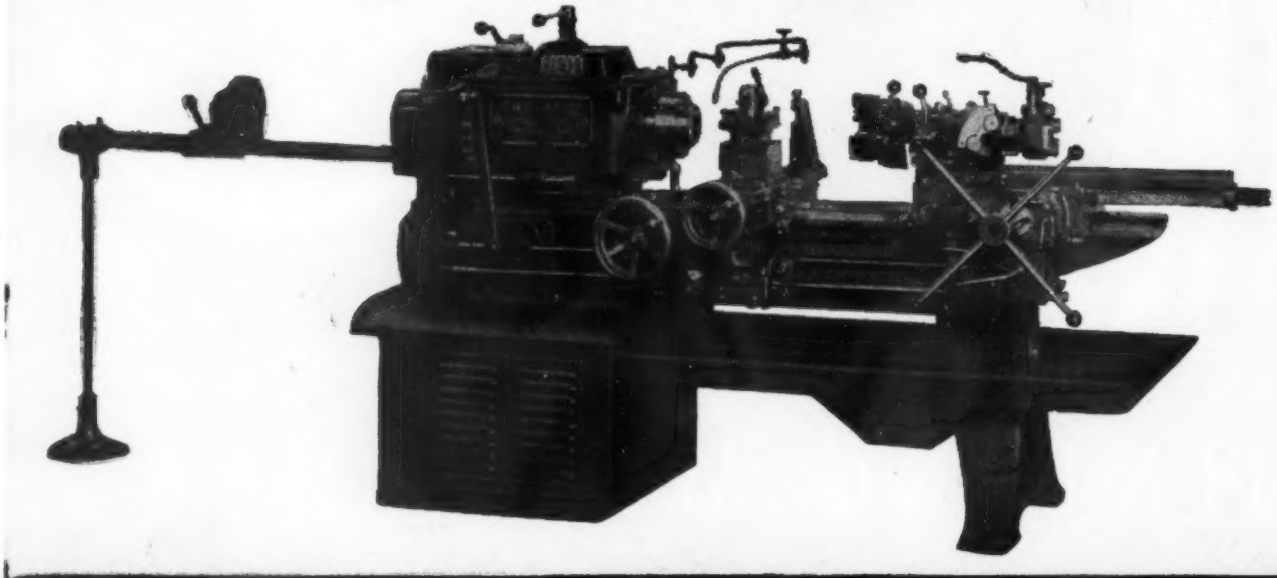
THIS Acme Ram Type Turret Lathe is fitted with Automatic Chuck and screw bar feed. It is also equipped with chasing attachment for cutting from 4 to 32 threads per inch. This attachment is extra and furnished only when required.

This type machine will accommodate round bar stock up to 2" on the No. 5R machine, and up to 2½" round stock on the No. 6R machine.

All of the most important features necessary to maintain accuracy and speed at low cost are incorporated in this design which includes:

- Hardened steel vees on bed.
- Hardened steel ram slide bearings.
- Triple roller spindle bearings.
- Twin nut back lash eliminator on cross screw.
- Non-overhanging headstock.
- Side carriage apron taper gibed to front bearing on bed.
- Independent feed ranges for either apron.

These are only a few of the many features.



The ACME MACHINE TOOL Co.
CINCINNATI 32, OHIO

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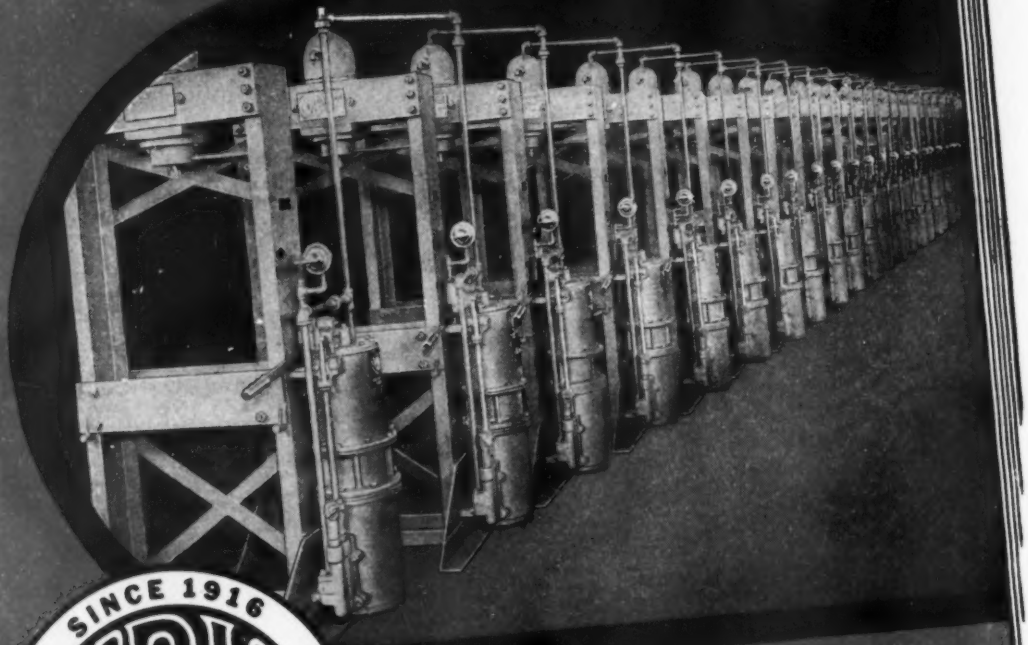
Electrolized TAPS
. . . CAN DO FOR YOU
ELECTROLIZED
1. MORE HOLES PER TAP
. . . 300 to 1000% More!
Electrolized Taps have enormously greater wear resistance and hold size infinitely longer.
2. BETTER, CLEANER THREADS
Electrolized Taps cut more freely. Chip and surface friction is reduced, chip weld minimized. Cleaner, finer finished threads are assured.
3. LOWER COST PER TAPPED HOLE
Electrolized Taps give you not only more holes per tap but more holes per machine and per operator. "Down time" is tremendously decreased.
You Can't Talk Quality Into a Tap
The only practical way to check these claims is to order a trial lot and to run comparative tests on your own machines, under your own operating conditions . . . Electrolized Taps are distributed by one of the more responsible mill supply houses in your locality, whose name will be sent to you, together with bulletin of styles, sizes and prices, upon request.
Electrolized TAP CORPORATION
148 WEST RIVER STREET
PROVIDENCE 1, RHODE ISLAND

HYDRAULIC
ARBOR PRESSES



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NEW KRW HYDRAULIC PRESS BOOK of PROFITABLE PRODUCTION IDEAS

NOW AVAILABLE AS HAND-OPERATED ELECTRIC-OPERATED AIR-OPERATED *Presses...*

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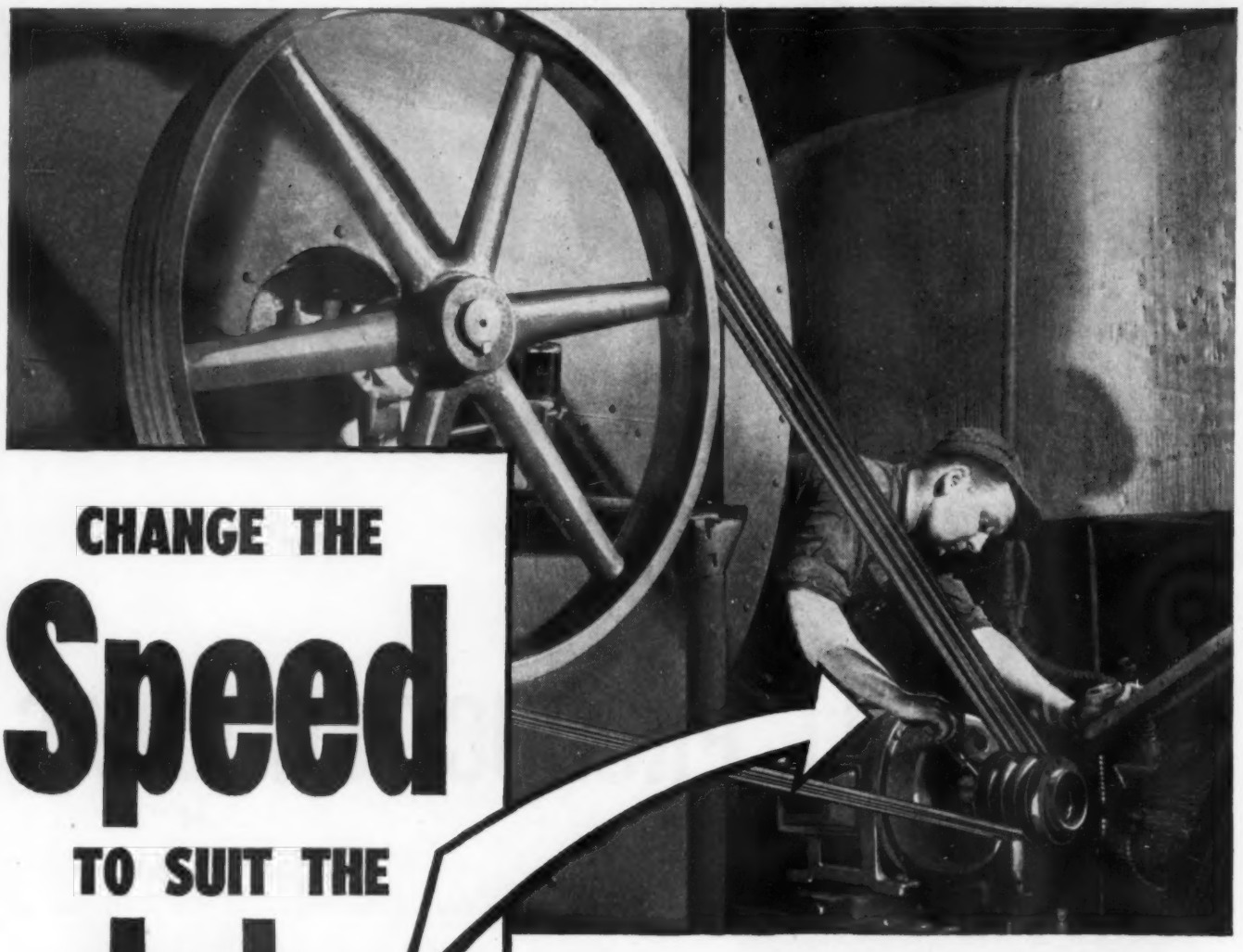

CHANGE THE Speed TO SUIT THE Job..

Texrope Vari-Pitch sheave makes it possible to vary the speed of this ventilating blower up to 25% to meet seasonal changes. Speed adjustment is quickly and easily made. A2102

Economical...TEXROPE Variable Speed Drives!

Whenever variations in speed will add to efficiency, production or economy — use TEXROPE Variable speed drives with standard constant speed motors. A Vari-Pitch sheave may provide all the speed range needed. They're available for stationary or motion control. Wide-Range Vari-Pitch sheaves and V-Belts provide greater range up to 116% — Speed Changers up to 375%.

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Sheaves, Speed Changers . . . V-Belts . . . Engineering Aid. Your nearest Allis-Chalmers office or dealer is headquarters for EVERY type of V-Belt Drive equipment. Save time by buying all your needs from one reliable source. Every item of equipment is designed and backed by Allis-Chalmers — originators of industry's Multiple V-Belt Drive. ALLIS-CHALMERS, MILWAUKEE 1, WISCONSIN.

"Magic-Grip" Sheaves are Faster ON . . . Faster OFF

Here's the sheave that requires no filing, reaming or hammering to mount — no wheel-puller or bulging muscles to demount. *It comes completely assembled.* Just slide it on the shaft and tighten three cap screws. That's all! Grips like a vise — no shear, wobble or backlash. No damage to shaft or motor bearings.

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment — Biggest of All in Range of Industrial Products

TEXROPE V-BELT DRIVES

Tools that give you "full measure"

All a skilled machinist can possibly ask of precision tools, Brown & Sharpe tools provide in fullest measure . . . accuracy, reliability, sound design and fine finish.

Typical of this full measure of desirable characteristics are Brown & Sharpe Micrometers, known the world over for such worthwhile qualities as: wear-resisting measuring surfaces . . . fine precision screw and spindle . . . adjustable thimble, providing simple, dependable adjustment . . . clear, easily read graduations and figures.

Nothing less than this full measure of Brown & Sharpe skill, knowledge and integrity can give you maximum return on your investment in fine machinists' tools.

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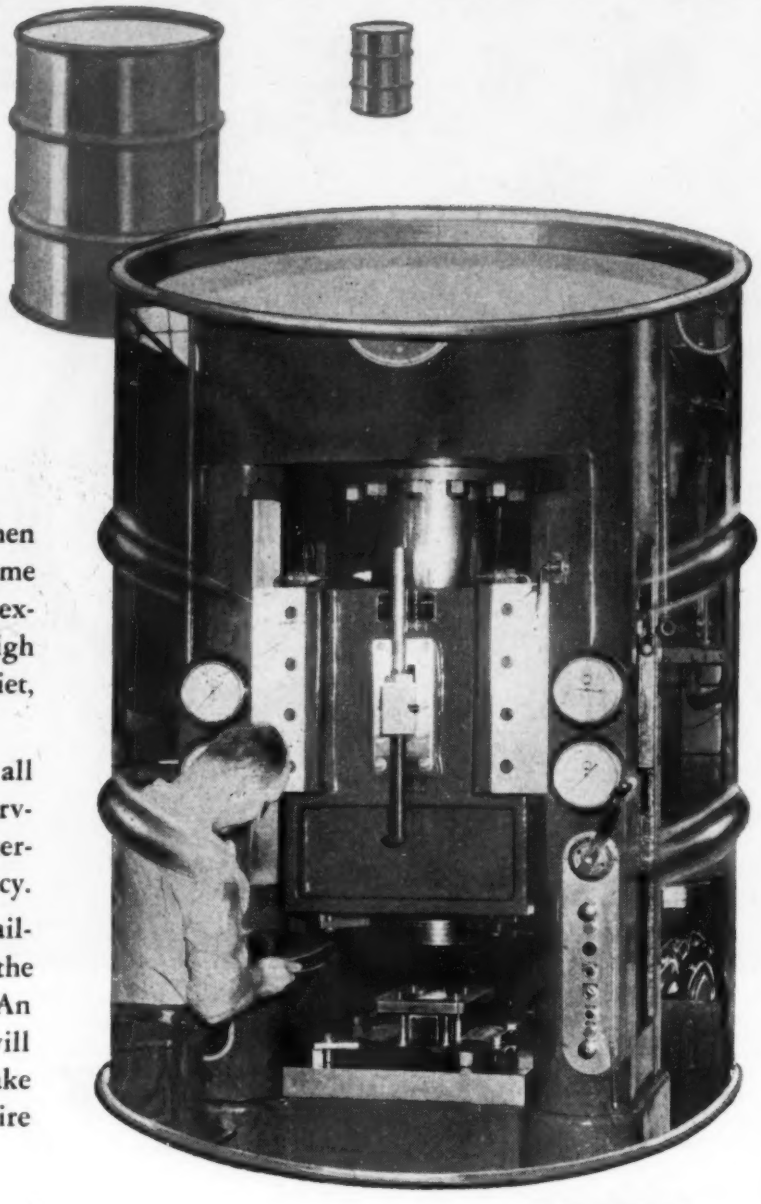
We urge buying through the Distributor B·S

BROWN & SHARPE TOOLS

Terona Oils...specialized MARATHON Lubricants for hydraulic equipment

Get smooth pump operation at all temperatures... with MARATHON Terona Oils



NO chatter—no jumpiness—not even when hydraulic pumps are operating at extreme temperature ranges. That's what you may expect when you use Terona Oils. Their high viscosity index and low cold test give quiet, smooth operation at all temperatures.

These are long-lived oils, too. Stable at all temperatures. Don't sludge or oxidize in service. And are non-foaming. All the characteristics you want to increase pump efficiency.

Marathon Terona Oils are immediately available in every necessary viscosity to suit the requirements of your particular pumps. An Ohio Oil Company lubrication engineer will be glad to examine your equipment and make lubrication recommendations. Just write, wire or phone.

Where compounded hydraulic oils are required for equipment, Marathon Vepressa, in correct viscosity, is recommended.

THE OHIO OIL COMPANY PRODUCES A COMPLETE LINE OF INDUSTRIAL OILS

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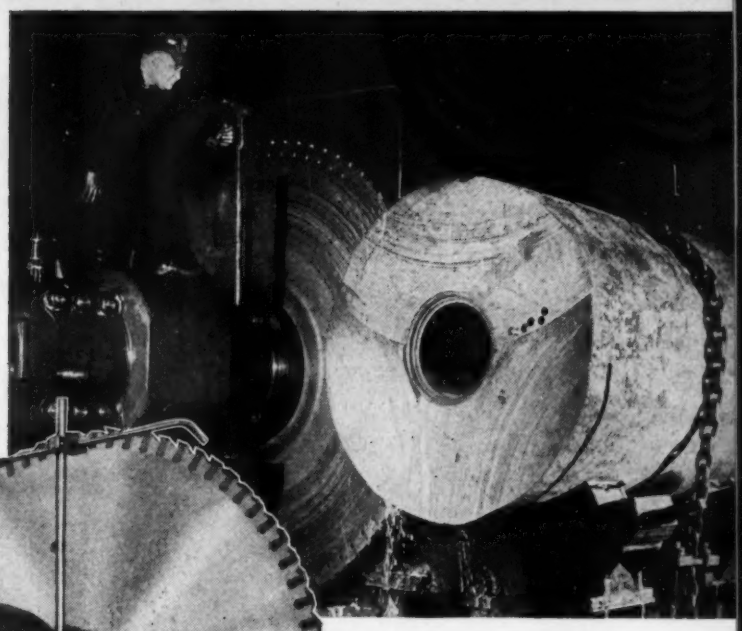
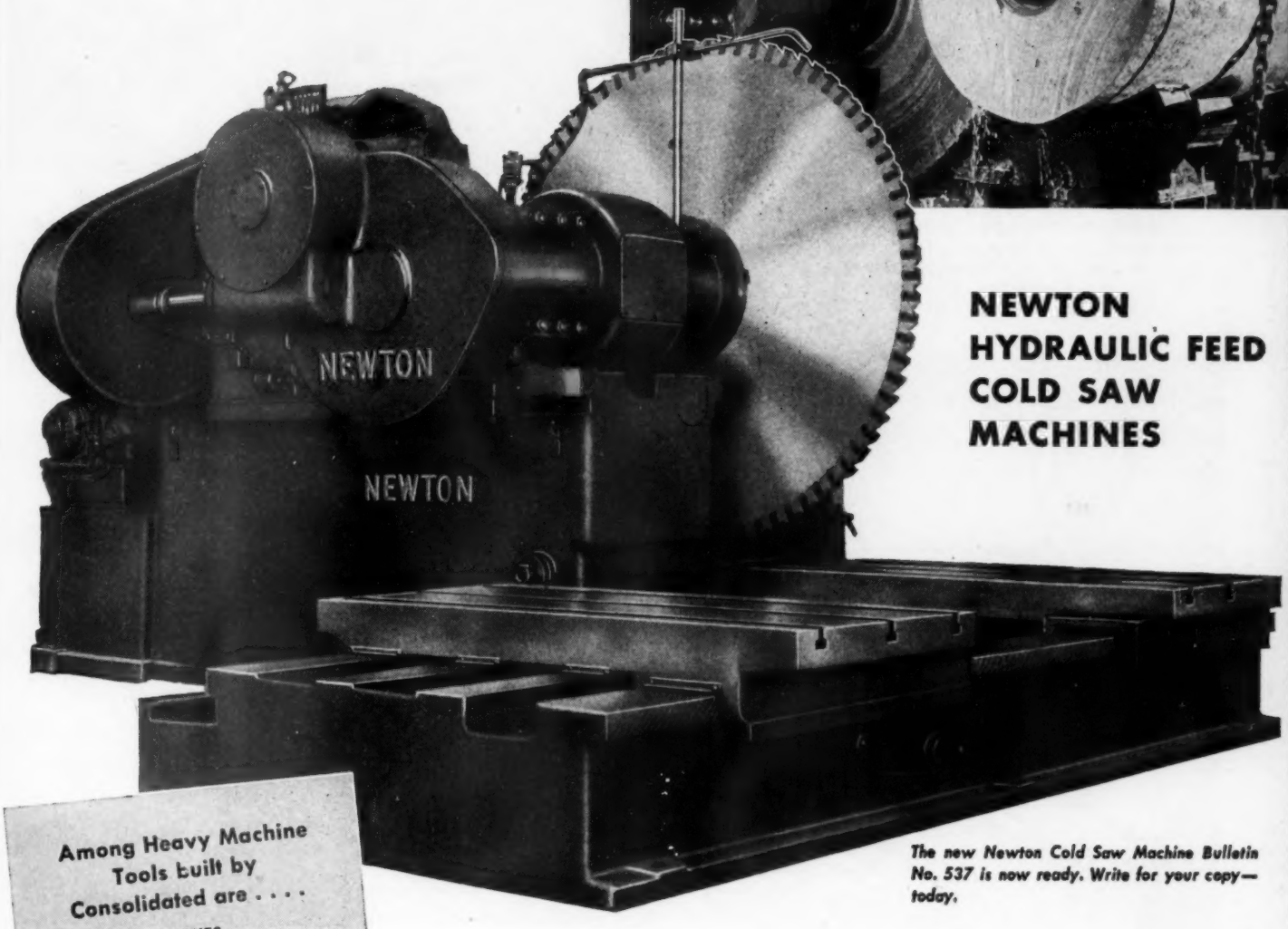
PRODUCERS OF PETROLEUM SINCE 1887

Their savings mean lower operating costs





NEWTON HYDRAULIC FEED COLD SAW MACHINES

The new Newton Cold Saw Machine Bulletin No. 537 is now ready. Write for your copy—today.

Among Heavy Machine Tools built by Consolidated are . . . .

LATHES
BORING MILLS
DRILL PRESSES
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AUTOMOTIVE TOOLS
AND OTHER
SPECIAL TOOLS

NEWTON Hydraulic Cold Saw Machines are built in a range of designs of proved adaptability to handling all types of work in either ferrous or non-ferrous metals. Built in sizes to accommodate blades from 32″ to 120″ diameter.

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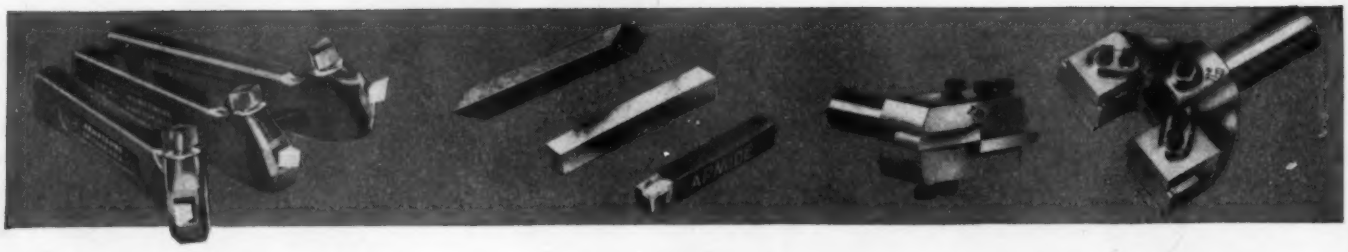
ROCHESTER 10, NEW YORK

ARMSTRONG

Quality TOOLS



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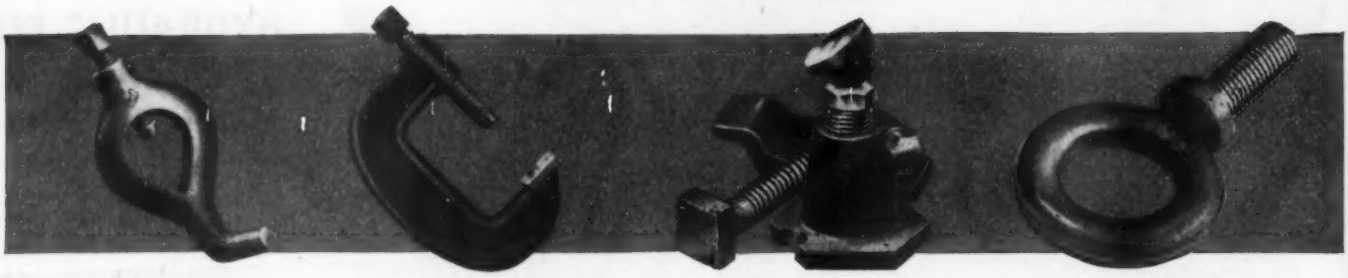
Permanent, multi-purpose tools, for every operation on Lathes, Planers, Slotters and Shapers.

ARMSTRONG HIGH SPEED
Ready-to-grind Bits...Ground Cutters.
ARMALOY Cast Alloy CUTTER-BITS
ARMIDE Carbide-Tipped CUTTERS
6 cutter shapes, 12 sizes—2 grades.

ARMSTRONG Turret Lathe and Screw Machine TOOL HOLDERS
Drill Holders, Cutter Holders, Finishing and Knurling Tools for standard operations.



ARMSTRONG Drop Forged DOGS
Lathe Dogs, Milling Machine Dogs, and Clamp Dogs. 12 types, all sizes.

ARMSTRONG Drop Forged "C" CLAMPS
Heavy Duty, Medium Service, Deep Throat, and Tool Makers' types in all sizes. Also Machinists' Clamps.

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A complete line of Drop Forged Strap Clamps, Planer and Bracing Jacks and T-slot Bolts.

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Plain or shoulder pattern. Blank or Threaded. 14 sizes, Drop Forged and heat treated.

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All steel wearing parts hardened. Packer, Railroad, Standard, and Short types, both plain and reversible.

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Both Carbon and Alloy Steel. Over 100 types in all sizes. Improved designs, steels, and heat treating ... stronger.

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All sizes and types with driving handles, extensions, and drop forged ratchets. Sold singly or in cased sets.

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Drill Drifts, Tool Posts, Drill Holders, Cutter Grinding Holders, and Tool Makers' Vices.

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Better Pipe Tools. A complete line, each a better tool with hardened, alloy or drop forged parts wherever they will add to strength or tool life.

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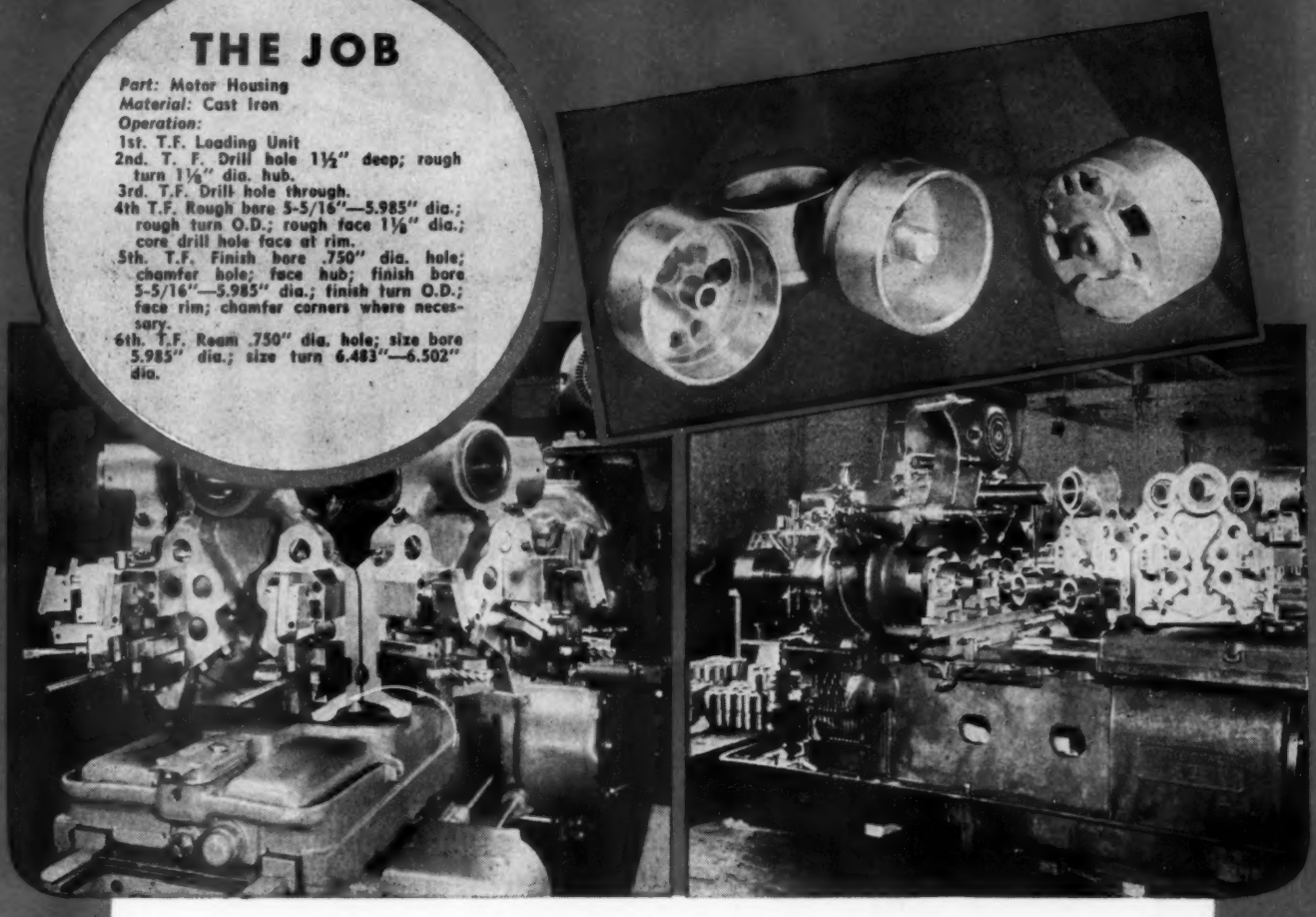
Planned Tooling results in fast floor-to-floor time on a P&J 5 D 2 AUTOMATIC

THE JOB

Part: Motor Housing
Material: Cast Iron
Operation:
1st. T.F. Loading Unit
2nd. T. F. Drill hole 1½" deep; rough turn 1⅛" dia. hub.
3rd. T.F. Drill hole through.
4th T.F. Rough bore 5-5/16"—5.985" dia.; rough turn O.D.; rough face 1⅛" dia.; core drill hole face at rim.
5th. T.F. Finish bore .750" dia. hole; chamfer hole; face hub; finish bore 5-5/16"—5.985" dia.; finish turn O.D.; face rim; chamfer corners where necessary.
6th. T.F. Ream .750" dia. hole; size bore 5.985" dia.; size turn 6.483"—6.502" dia.



Ability to duplicate the cast iron motor housings shown here quickly and accurately on the P&J 5D2 Automatic is the result of planned tooling and the well-known productivity of two-spindle performance. The actual figures for floor-to-floor time and number of pieces per hour are outstanding and will be furnished on request.

All P&J machines have the inherent advantage of tooling flexibility, making possible not only special tooling for each specific job but also the means of changeover in tooling for the wide range of jobs that can be handled on these highly productive machines.

Utmost turret stability is assured by the rigid type overhead pilot which is characteristic of P&J design. This feature together with ample power makes it possible to produce accurately at high speed and low maintenance. Operating convenience results in minimum fatigue and conserves man-power.

Our engineers are ready to help you cut costs in duplicate parts production and welcome an opportunity to show you how it can be done.

THE POTTER & JOHNSTON MACHINE CO.

Pawtucket Rhode Island

We certainly don't expect you to join our growing list of customers *unless* we can give you better abrasive products for *your particular production jobs* . . . plus better service.

Our rapid growth in ten years from one of the smallest makers of abrasive products to one of the largest, didn't just happen. Company after company found we could help them get better production, lower costs . . . and give them better service. That's how we built our business.

Should you use MID-WEST abrasives? The only way we know for finding out is for you to give us a trial. It's worth it . . . if you're looking for better production, lower costs, and better service. Call us. We'll cooperate.

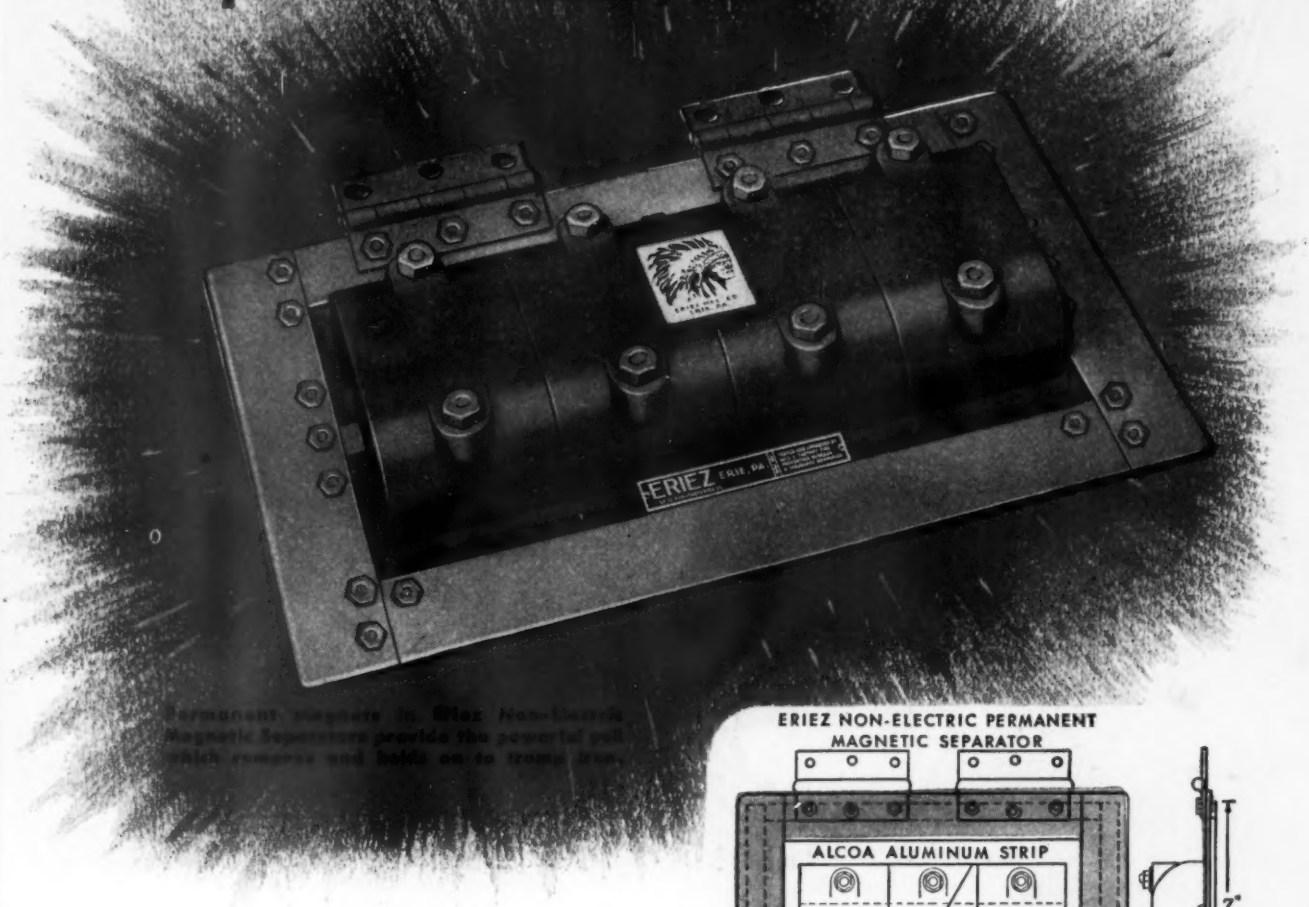
James Jackson
PRESIDENT

MID-WEST ABRASIVE COMPANY

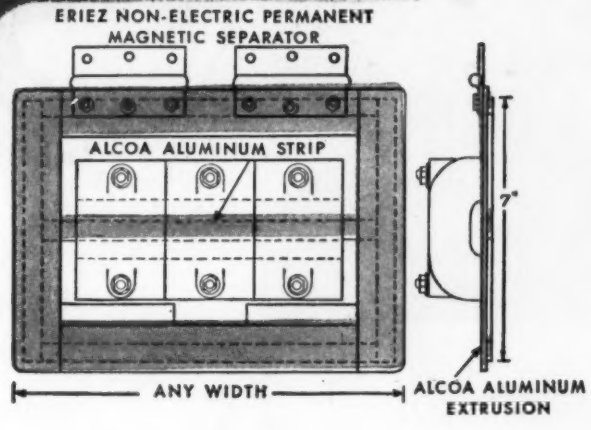
OWOSSO, MICH. DETROIT ROCHESTER, PA.

GRINDING WHEELS HONING STONES COATED ABRASIVES

Because Aluminum is nonmagnetic, it helps catch tramp iron



Permanent magnets in Eriez Non-Electric Magnetic Separators provide the powerful pull which removes and holds on to tramp iron.



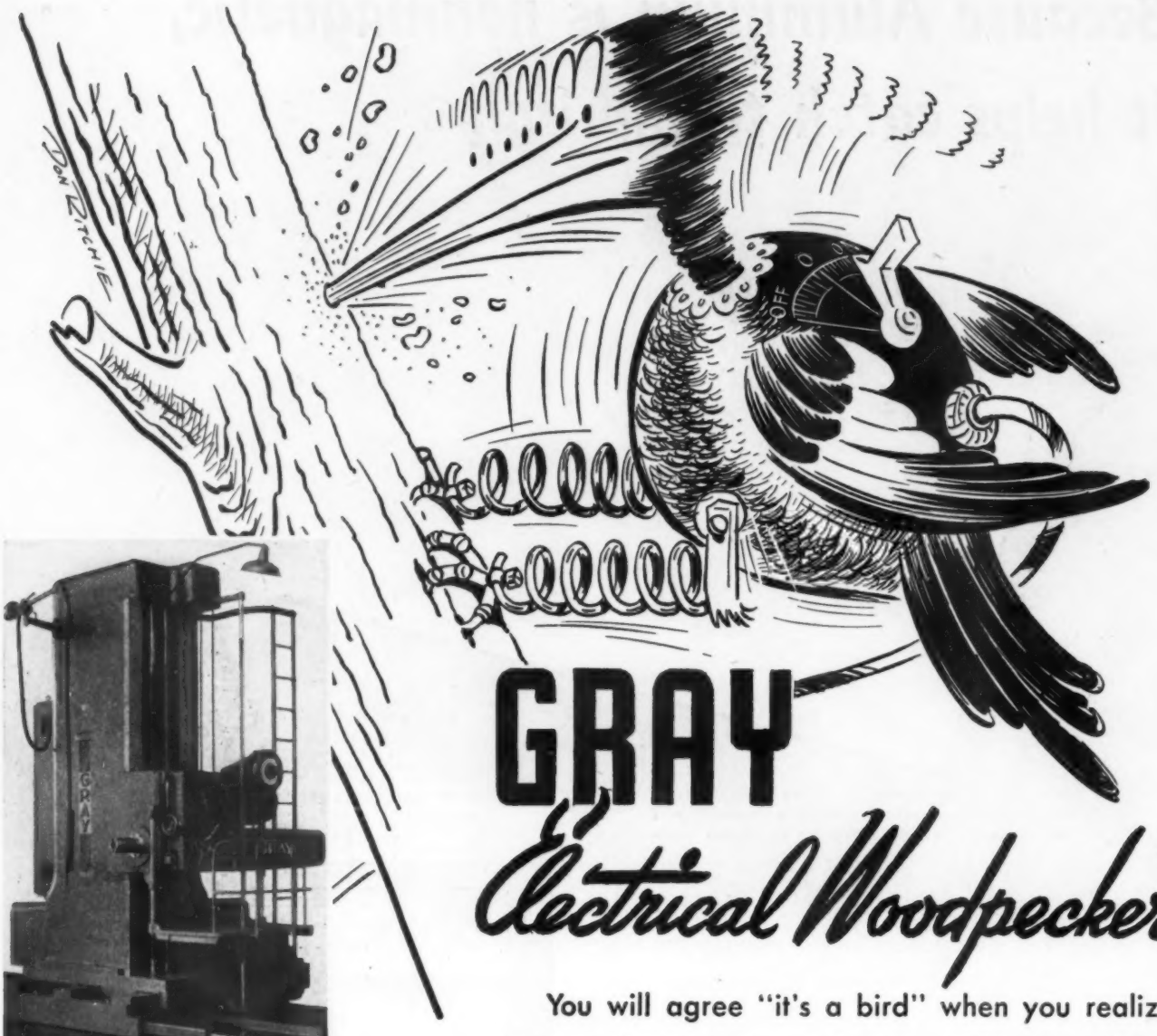
All the power of these Alnico permanent magnets is available for useful work—removing tramp iron from materials passed near them. Their mounts are nonmagnetic Alcoa Aluminum, so there's no short circuiting of the magnetic forces.

Some users go a step farther, and make complete chutes and troughs of Alcoa Aluminum, thus avoiding dissipation of magnetic forces there. Materials passed through them get added protection; aluminum is highly resistant to corrosion, so there's less chance of contamination.

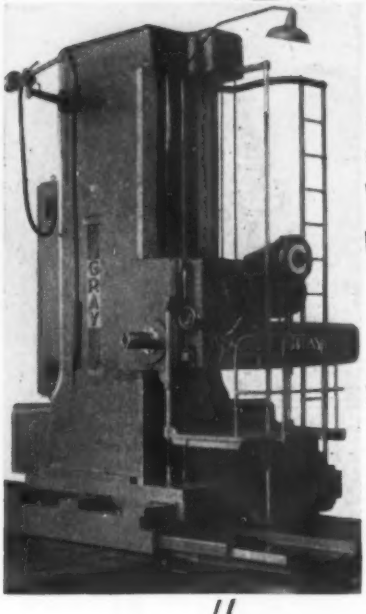
Whether your problem is one of engineering or manufacturing, our engineers stand ready to assist in incorporating Alcoa Aluminum. Call the nearby Alcoa office, or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

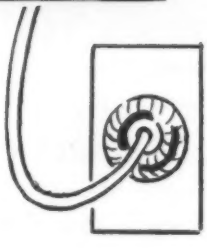
ALCOA FIRST IN **ALUMINUM**

IN EVERY COMMERCIAL FORM



GRAY
*Electrical Woodpecker**





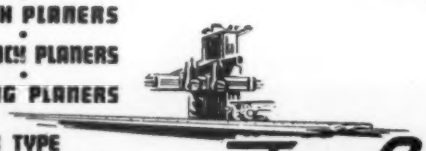
You will agree "it's a bird" when you realize that it enables you to set the twenty-five ton column within a quarter of a thousandth of an inch by simply operating a jogging button.

This is one of the many exclusive features of Gray Boring, Drilling and Milling Machines.

Write for full illustrated descriptive Bulletin No. 48.

* *Protected by patent No. 2,354,413*

DOUBLE HOUSING and OPENSIDE PLANERS
•
SWITCH PLANERS
•
DIE BLOCK PLANERS
•
MILLING PLANERS
•
PLANER TYPE MILLING MACHINES
•
HORIZONTAL BORING MACHINES



The G.A. GRAY Co.

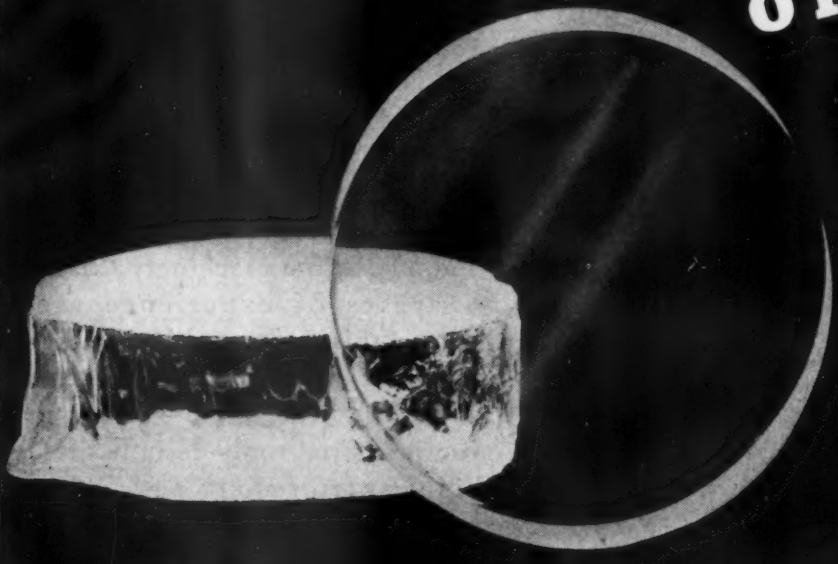
CINCINNATI 7, OHIO, U. S. A.

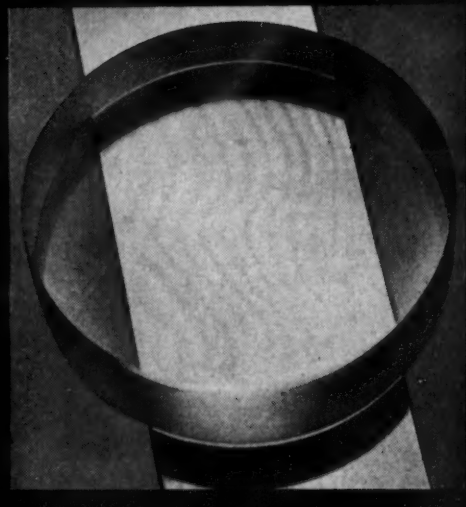
Sold in Canada by Upton, Bradeen and James Ltd. ● Sold in Latin America by Machine Affiliates.

Ultimate Accuracy
IN PRECISION CHECKING OF GAGES AND LAPPED PARTS
assured by

Van Keuren

FUSED QUARTZ OPTICAL FLATS



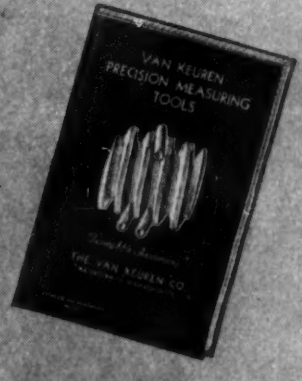


The use of optical flats for precision measurements with light waves as pioneered by The Van Keuren Co. in 1920. The new Van Keuren double surface, pure fused-quartz flats are the result of 25 years of experience. The accuracy and workmanship is superlative.

Fused quartz is highly transparent and has exceptional wearing qualities. The expansion and contraction due to temperature change 1/16 that of plate glass and 1/6 that of pyrex.

Specify Van Keuren double surface, fused-quartz optical flats for checking flatness of precision lapped parts, maintenance of amplifying gages, and control of gage block wear. They are the most economical to purchase and the most accurate to use.

Worn spot .000023" deep revealed on amplifying gage anvil by means of a Van Keuren optical flat.



Consult the 160-page Van Keuren Catalog No. 33 for further details. Send for your copy which also contains complete tables, data and formulas for measuring threads, gears, gages and precision parts.

Van Keuren

27th YEAR

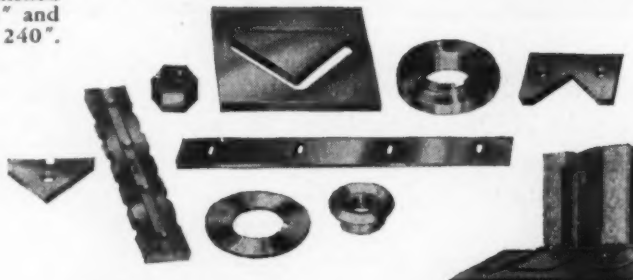
The TOOLS behind this Trade-mark

HILL ACME TOOLS FOR INDUSTRY

• The HILL ACME Company—a consolidation of two nationally known manufacturers... The Hill Clutch Machine & Foundry Co. and The Acme Machinery Co... 61 years of experience are behind this trade-mark! Through constant research, Hill Acme engineers will continue to bring you industrial tools designed for higher performance and lower maintenance cost.

VERTICAL GRINDER

"HILL" Open Side Vertical Spindle Hydraulic Grinders are designed for rapid stock removal and accurate grinding of flat surfaces. Furnished in table widths of 18", 24" and 30"; table lengths 60" to 240".



SHEAR KNIVES

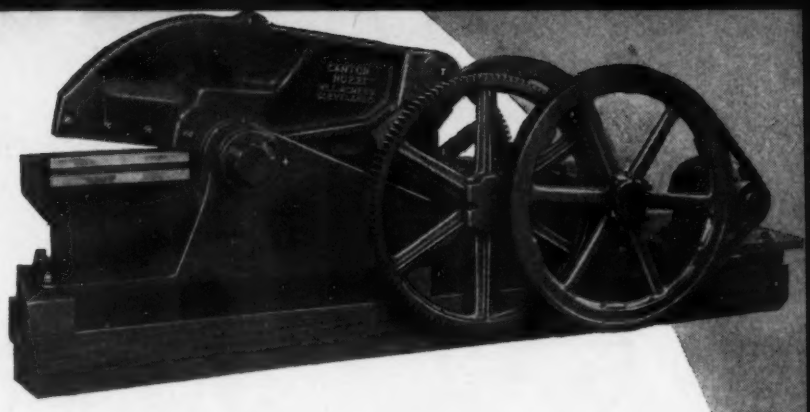
"CLEVELAND" Knives and Shear Blades. Solid and laid steel shear blades; rotary slitting and side trimming knives; metal cutting machine knives; knife sharpening service.

FLOOR CRANE

"CANTON" Portable Cranes are constructed of welded steel, with high tensile drop forgings; equipped with self locking worm as safety feature. Made in eight sizes from 1 to 3 Ton capacity. Fast, safe, one-man operation.

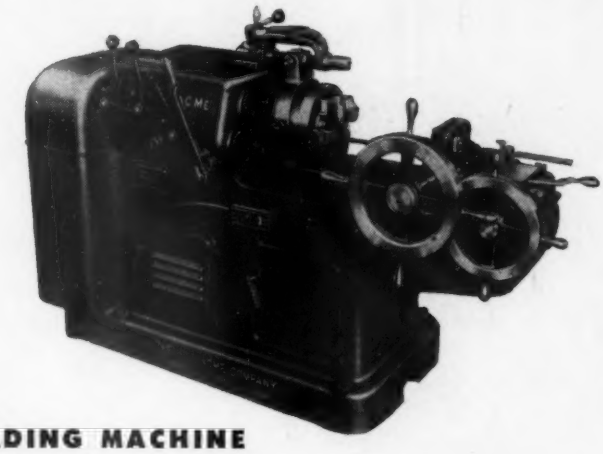
HORIZONTAL GRINDER

"HILL" Open Side Horizontal Spindle Hydraulic Surface Grinders for accurate grinding of flats, angles, irregular and special shaped surfaces. Furnished in table widths up to 36"; table lengths 60" to 240".



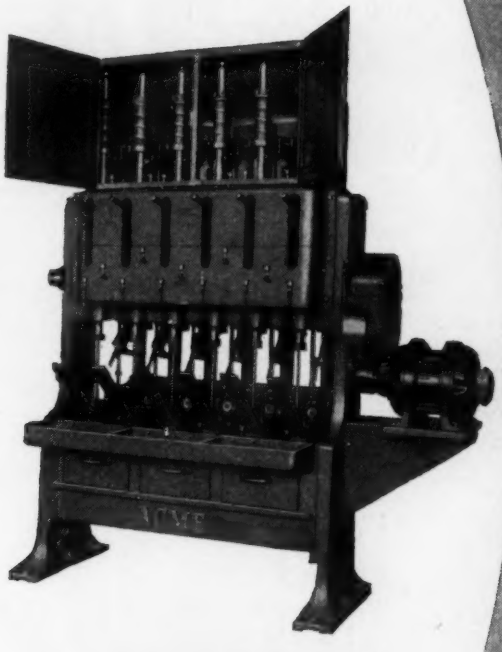
ALLIGATOR SHEAR

"CANTON" Alligator Shears are the most rugged, powerful and trouble free shears ever built for processing scrap. Modern design has produced a stronger shear, with fewer parts, and positive lubrication. Made in a full range of sizes to meet every condition.



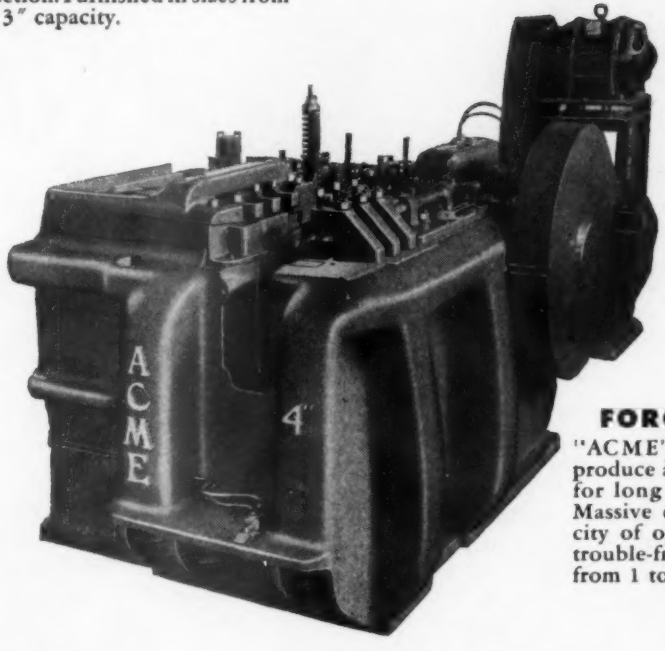
THREADING MACHINE

"ACME" XL Single and Double Spindle Threading Machines are equipped with patented tangent or hob type die head which assures economical, accurate, high speed production. Furnished in sizes from 1″ to 3″ capacity.



TAPPING MACHINE

"ACME" Tapping Machines for accurately threading nuts and pipe couplings. Built in 4, 6 and 8 spindle sizes with capacities of 1, 2 and 3 inches.



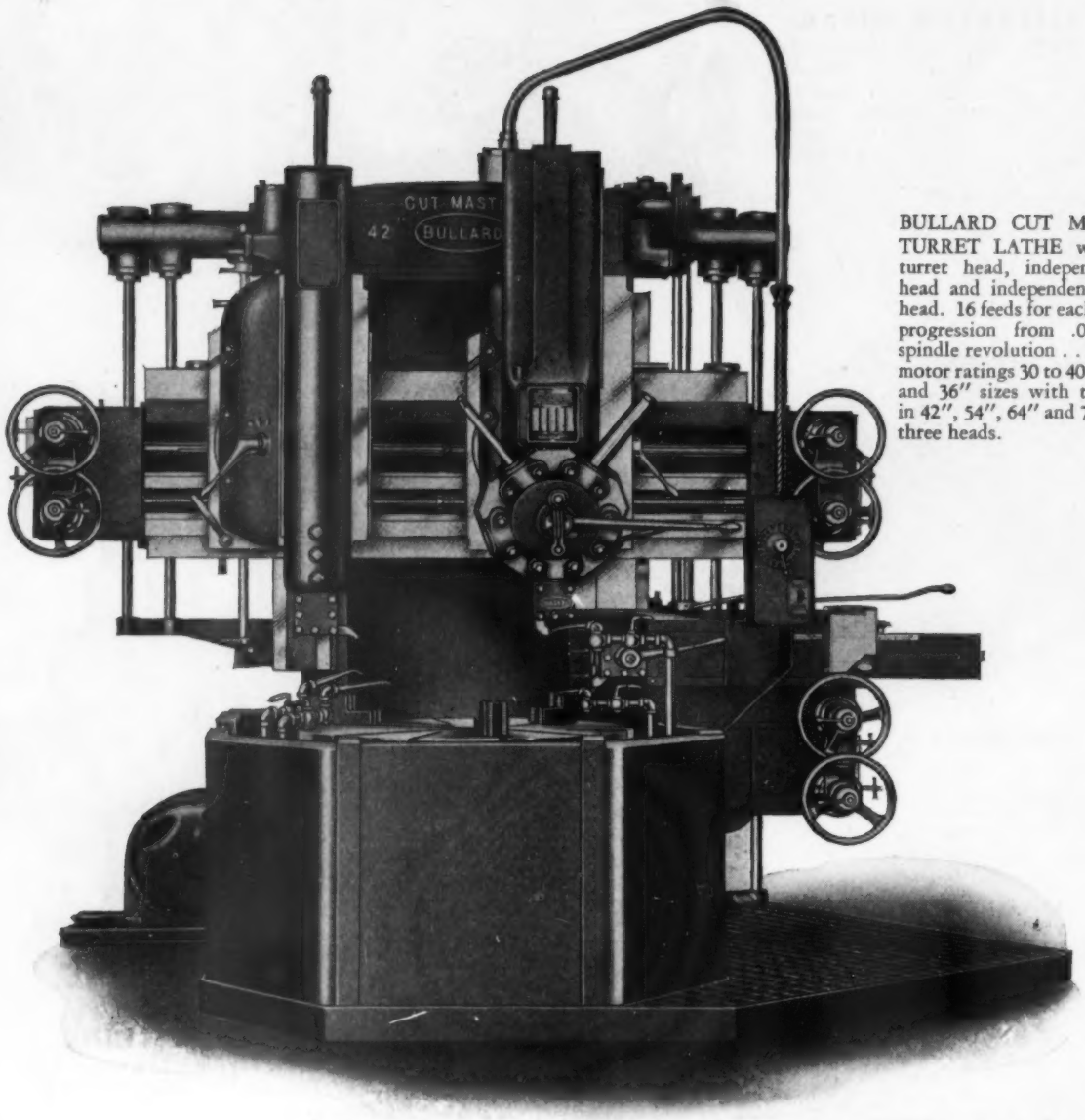
FORGING MACHINE

"ACME" XN Forging Machines produce accurate, quality forgings for long uninterrupted periods. Massive construction and simplicity of operation insure years of trouble-free service. Built in 7 sizes from 1 to 5 inches.

The HILL ACME Company

PLANTS AT 6400 BREAKWATER AVENUE
AND 4533 ST. CLAIR AVENUE

Cleveland 2, Ohio



BULLARD CUT MASTER VERTICAL TURRET LATHE with swiveling main turret head, independent left-hand ram head and independent non-swiveling side head. 16 feeds for each head in geometrical progression from .0026" to .500" per spindle revolution . . . 20 table speeds . . . motor ratings 30 to 40 hp. Available in 30" and 36" sizes with two heads only . . . in 42", 54", 64" and 74" sizes with two or three heads.

UNIT PRODUCTION COSTS ARE LOWER

when you cut machining time both ways

1. CUT TIME ON CUTS

Bullard Cut Master Vertical Turret Lathes remove more metal in less time than any other machines of the same type because they offer the best combination of rigidity, freedom from vibration, smooth flow of power and wide range of speeds and feeds. That's why they permit you to take full advantage of the latest developments in cutting tools for heavy, accurate cutting.

2. CUT TIME *BETWEEN* CUTS

Bullard Cut Masters keep lost time between cuts at the minimum because of fast chucking — two or three heads working simultaneously — independent rapid power traverse of each head in any direction which brings tools quickly to within a fraction of an inch of the work — quick and easy engagement of proper feed and convenient location of all operating controls.

For further reasons why Bullard Cut Masters give peak production by *cutting time on and between cuts*, write for your free copy of Bulletin CVTL-4-1-46, today. The Bullard Company, Bridgeport 2, Connecticut.

BULLARD

CREATES *NEW METHODS*

TO MAKE MACHINES DO MORE

Here's the **least** of your troubles...
when you don't **keep everything under "COUNTROL"**

On the green, an argument over a few strokes more or less is not too serious (or is it?). But let an argument flare up between a manufacturer and a customer over performance figures—when there's a question whether the product has fulfilled its guarantee—and there you have something *mighty serious*. Especially if there's no acceptable proof on either side. *Then the guarantor has everything to lose.*

And that's one reason why so many builders of so many different types of products are building-in Veeder-Root *Countrol* as an integral feature of design. *Other reasons:* Added utility, new sales appeal, new convenience and savings for users. But what's *Countrol*? Accurate "Facts-in-Figures," supplied by a standard Veeder-Root Counting Device, and related either to elapsed time, or to time-interval remaining (see the interesting instance* below). Where can *Countrol* be applied? To practically any machine, product or process operated mechanically, electrically, or by flow.

See a Veeder-Root engineer. He'll help you to get a guarantee witness you can count on . . . and also to find, in your product, some new merchandising feature that you had never counted on. Write.

VEEDER-ROOT INC.

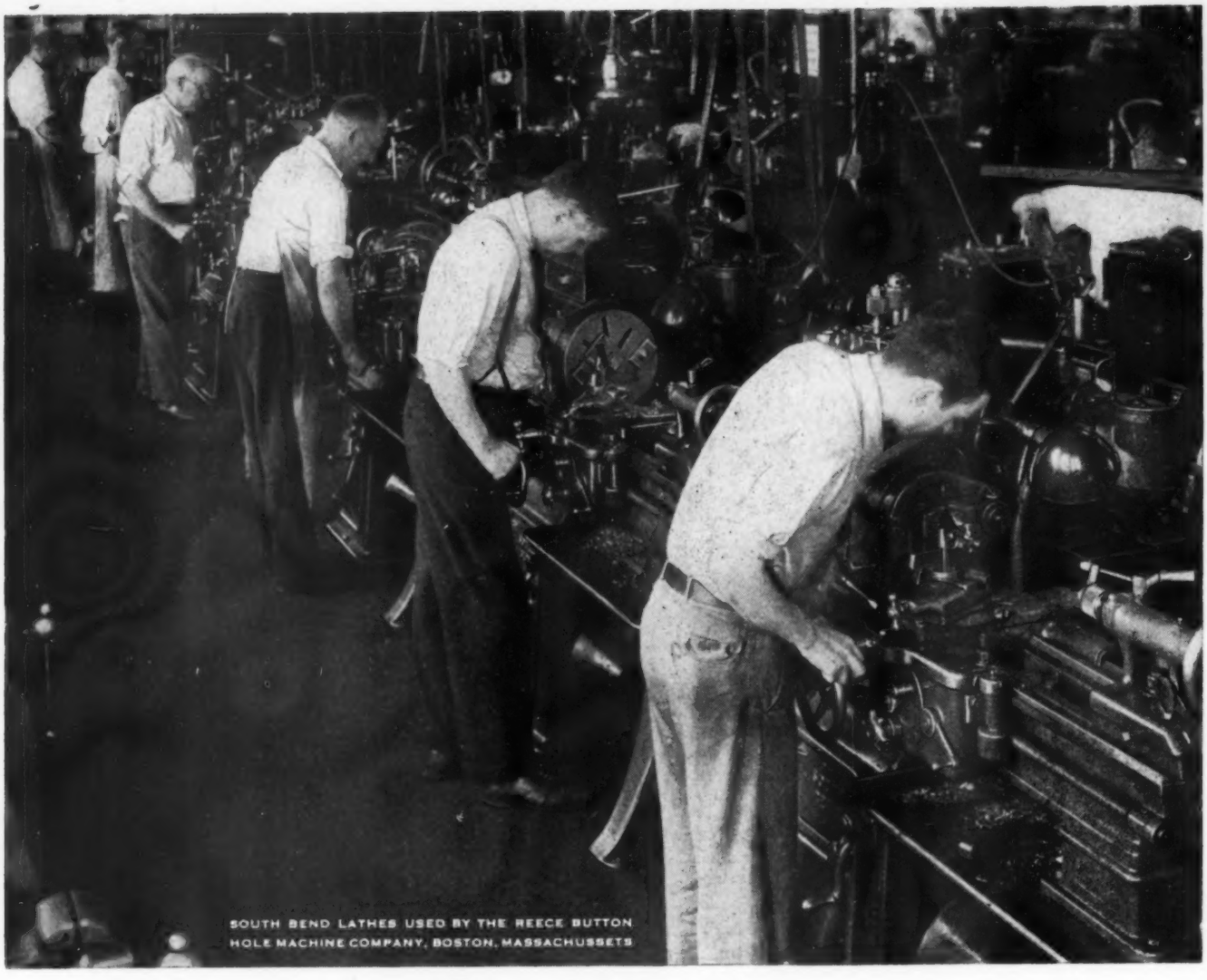
Hartford 2, Connecticut

In Canada: Veeder-Root of Canada, Ltd., Montreal
In England: Veeder-Root Ltd. (New address on request)

The Counting House of Industry

Veeder-Root COUNTROL in JET PLANES

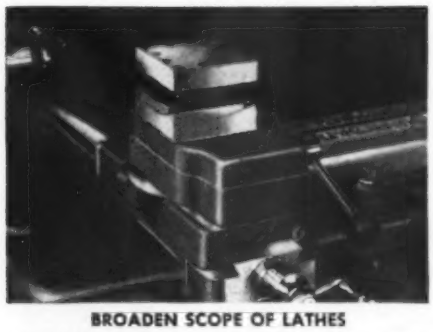
*Interesting instance of limitless adaptability of V-R *Countrol* is this *special* counter developed to show jet pilots how many gallons of fuel they have remaining in their tanks at all times. Counter subtracts from original number showing total gallons when tank is full.



SOUTH BEND LATHES USED BY THE REECE BUTTON HOLE MACHINE COMPANY, BOSTON, MASSACHUSSETS

SOUTH BEND LATHES

Speed the Flow of Production



BROADEN SCOPE OF LATHES

A complete line of South Bend attachments and accessories further increases the versatility and productiveness of South Bend Lathes. Write for illustrated Accessory Catalog 77.

Time saved in machining operations helps speed the flow of production, reduces manufacturing costs, and increases profits. A few seconds cut from each operation are highly important. Machine tools that are easy to operate, that can handle a wide variety of operations, consistently produce work to specified tolerances and finish, and stay "on the job" day after day with a minimum of maintenance, are profit-producing installations. Because South Bend Precision Lathes offer these, and other outstanding advantages, they are the choice of leading industries and shops everywhere. A South Bend Lathe distributor near you will be glad to help you select the lathes and equipment best suited to your requirements. Write today for his name and a copy of Catalog 100-D which illustrates in full color and completely describes the entire line of South Bend Precision Lathes and Attachments.

LATHE BUILDERS SINCE 1906

SOUTH BEND LATHE WORKS

419 EAST MADISON STREET • • • SOUTH BEND 22, INDIANA

...GIVES YOU ITS OWN SALES TALK

The Garvey Junior Marker is made of Alcoa Aluminum Tubing and Alcoa Screw Machine Products

This automatic fountain marker's pride in its own performance and appearance is understandable. Made of Alcoa Aluminum, it is light in weight and tireless to work with. Dressed in a handsome, hard Alumilite* finish, there's no "wear out" to it.

Again you see an example of how manufacturers are employing Alcoa Aluminum to make finer, better looking products. Does it suggest new uses to you?

The best time to incorporate Alcoa Aluminum in your products is while they're in the design stage. Slight changes there often permit big savings in manufacturing costs. For help in including aluminum, get in touch with the nearby Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2107 Gulf Building, Pittsburgh 19, Pennsylvania.

Process patented by Aluminum Company of America

ALCOA FIRST IN ALUMINUM

IN EVERY COMMERCIAL FORM

ON *One* PRECISION LATHE DO ALL THIS AND IN LESS TIME . . .

- BALL TURNING
- SPIRAL CUTTING
- MILLING
- GRINDING
- MULTIPLE OPERATIONS
- RELIEVING
- SLOTTING
- FORMING
- TAPER TURNING

All possible through precision-made attachments.

The Rivett No. 608 back-geared, screw cutting lathe for tool making and instrument shops, handles an endless variety of jobs in minimum time. This small but exceedingly proficient lathe with slide areas equal to that of one twice its size, permits the operator to finish his work completely without employing other machines.

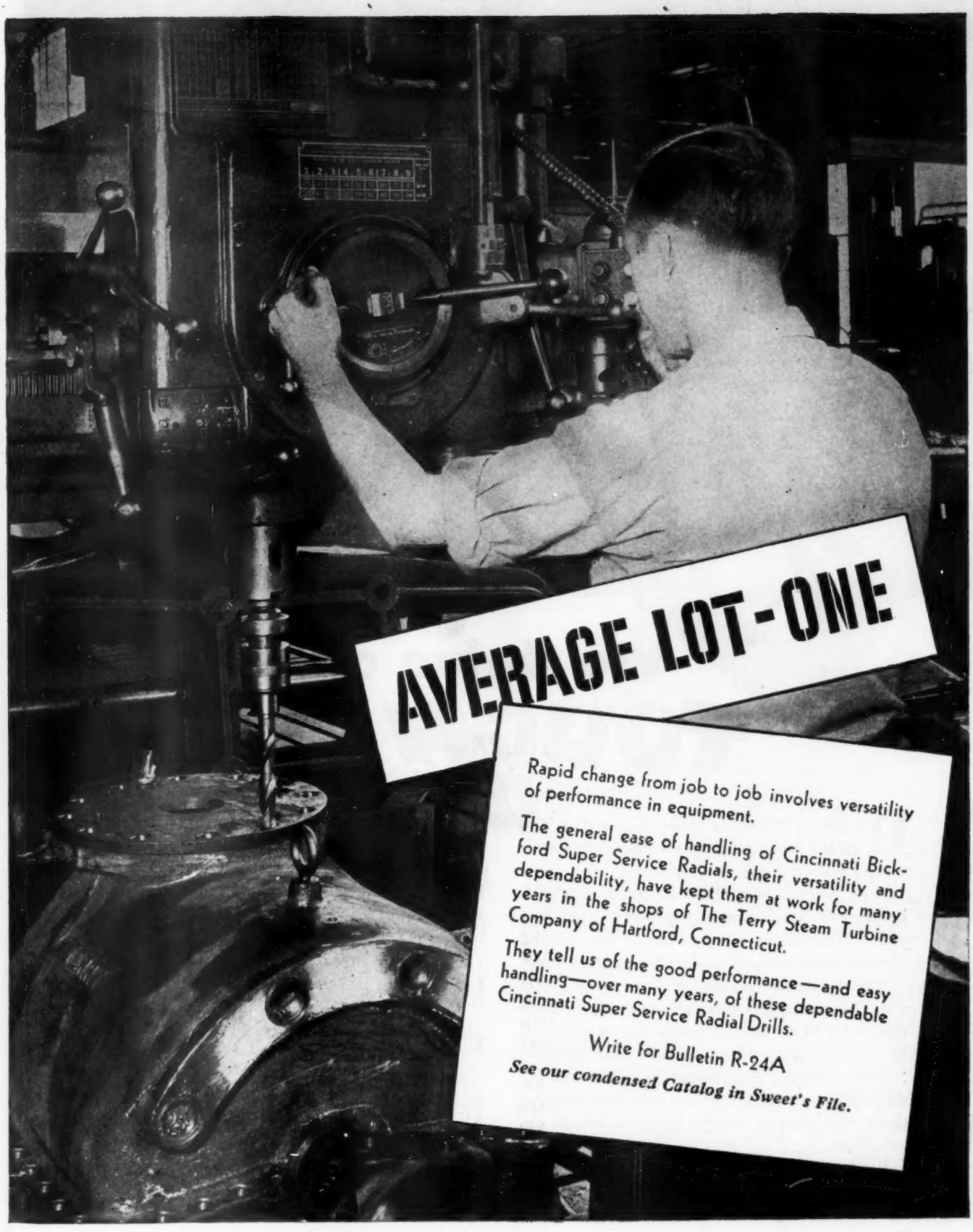
WRITE FOR BULLETIN NO. 608

GUARANTEE

The Rivett 608 will turn or bore within 0.0001" in six inches — work held in collet, and turn between centers within 0.0001" in six inches. It will face to eight inches diameter within limit of 0.0002" concave, 0.0000" convex. It will cut threads within 0.0005" in twelve inches, or within 0.0003" in any three inches, or within 0.0002" in any inch of a specimen piece.

RIVETT LATHE & GRINDER INC.

BRIGHTON, BOSTON, MASS., U. S. A.


AVERAGE LOT-ONE
Rapid change from job to job involves versatility of performance in equipment.
The general ease of handling of Cincinnati Bickford Super Service Radials, their versatility and dependability, have kept them at work for many years in the shops of The Terry Steam Turbine Company of Hartford, Connecticut.
They tell us of the good performance—and easy handling—over many years, of these dependable Cincinnati Super Service Radial Drills.
Write for Bulletin R-24A
See our condensed Catalog in Sweet's File.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

- *Equal Efficiency of Every Unit Makes the Balanced Machine.*

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9. Ohio U.S.A.**

We thrive on the TOUGH ONES!

HE generally comes alone to see you. You called for him because something's gone wrong with a machine or process . . .

Now you tell him about it, and it turns out he knows a lot about equipment just like yours. Nine chances out of ten he can tell you right off what to do. You feel better right away.

And the tenth chance? Well, that's the tough nut. Our man goes away . . . and comes back double! Yes, he brings another man who may be a chemist . . . or a former machine designer . . . or a former shop superintendent . . . but definitely a specialist. These two men between them can almost always fix your tough nut problem.

But how about that one problem that stumps both men? Now you get something special! The research laboratory enters the picture . . . a new formula is developed . . . the refinery produces a trial lot . . . and you receive a sample.

You try the new stuff — *and it's O.K.!* Then you tell your Boss: "Sure was a headache, but here's how I licked it . . ."

And you did! Didn't *you* think of calling the Shell Lubrication Engineer?

* * *

Call your local Shell Representative, or write Shell Oil Company, Incorporated, 50 West 50th Street, New York 20, New York; or 100 Bush Street, San Francisco 6, California.

SHELL MARINE LUBRICANTS

SHELL

American Machinist's Spot NEWS OF METALWORKING

Army Air Force estimates 27 aircraft companies now have contracts for planes, guided missiles and parts. Total AAF backlog is about $654,000,000, of which $579,000,000 is for airplanes and $175,000,000 for experimental work.

Even though plans to make all-Australian cars are being rushed by Ford, General Motors and International Harvester, it will take until 1949 before even partial independence from imported American chassis and engine parts can be achieved.

National Housing Authority enthusiasts in prefabricated housing believe that forced acceptance of prefabs in the emergency may lead to large-scale factory output of buildings, calling for new kinds of tools and presses. Government will boost aluminum output and channel it to prefab manufacturers.

A large car builder should have delivered 254 Pullman cars last month, but not one was actually completed because of shortages of electrical equipment.

National Railways of Mexico will assemble 2,000 railroad freight cars on an improvised assembly line in their main repair shop with American parts and equipment. This work, plus the import of 3,000 American freight cars just arrived in Mexico will help ease a critical transportation situation.

Farnham Manufacturing Co., Buffalo, is producing forming rolls used in making leading edges of airplane wings, for shipment to DeHaviland Aircraft Co. in England. Farnham has inquiries from other countries for aircraft production equipment. Russia and China have asked about milling machines for making wing ribs.

Recent price declines of many foods are causing more industry executives to speculate on future labor demands if living costs decline. Some observers feel that a price turndown would do more to halt another wave of strikes than anything else.

The British will try to attract buyers from all over the world to its first postwar Industries Fair, to be held in London and Birmingham from May 5-16, 1947. The Birmingham section will display engineering and hardware exhibits, and the London section will feature lighter industry products.

Electro-Motive and Fairbanks-Morse are girding for a battle with Eastern builders of diesel-electric locomotives. Electro-Motive and Fairbanks-Morse champion the two-cycle engine for railroad use, while Baldwin Locomotive and American Locomotive favor the four-cycle engine.

Fairey Aviation Co., London, has acquired controlling interest in Weatherley (Oilgear), Ltd., makers of machine tools and other engineering products, incorporating special patented hydraulic equipment under agreement with Oilgear Co., Milwaukee. Fairey will apply hydraulic equipment to aviation products.

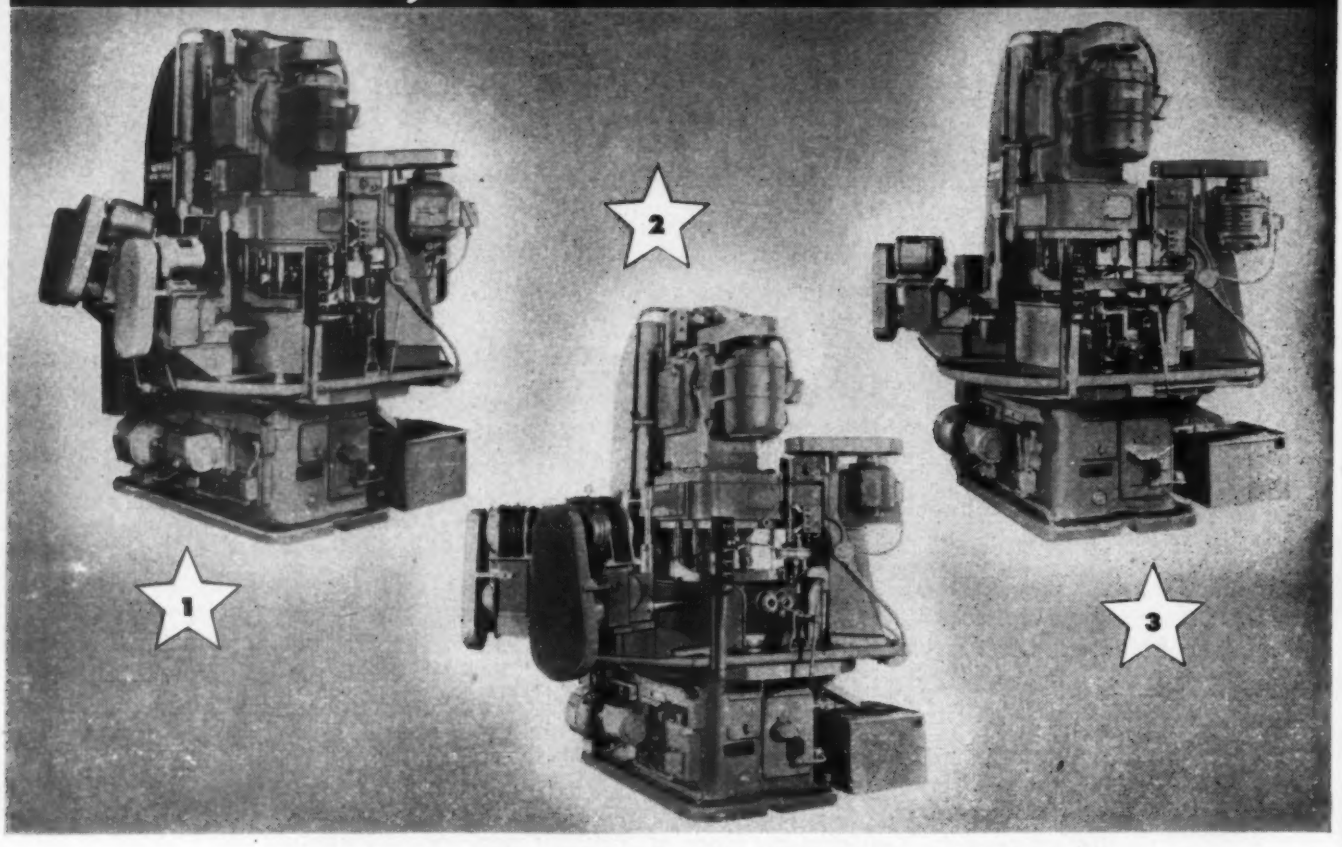
The Australian Tariff Board refused to impose protective duties on imported die-heads, because domestic producers failed to prove that they were uneconomic. American, British and Swedish die-heads were involved.

Besides being short of steel sheets, British motor manufacturers still have a big headache getting castings. One company has arranged to obtain supplies of castings, including brake drums, from Belgium.

One large metalworking company is diverting sheet steel from automobiles to refrigerators, largely because it can make more money on refrigerators and must operate at a loss on autos.

Cutbacks by large metalworking companies have been reflected in lowered operations by many suppliers. Some suppliers say that for the first time since prewar days workers are seeking jobs instead of jobs seeking workers.

MORRIS MOR-SPEED
High Production Trio



● This group of machines was designed and built by Morris to perform a series of operations on a transmission part and the three machines function as a battery—the work moving from one to the other. All three of these are Hydraulic Vertical Type Machines with automatic indexing.

No. 1 has 8 vertical spindles—2 tapping spindles—and 5 angular heads each carrying one spindle set at different angles. The angle heads are on the platen, have individual motor drives and are fed through racks and pinions connected to the vertical feed hydraulic unit. All spindle feeds, except the tapping spindles, are controlled by the movement of one hydraulic unit. The Tap Head has individual reversing motor drive with thread screw lead. This machine is set up for drilling—facing—rough and finish reaming—counterboring and tapping operations.

No. 2 has 7 vertical spindles—3 horizontal boring spindles and 1 tapping spindle. The machine handles drilling—reaming—facing—chamfering—boring and tapping operations.

No. 3 has 16 vertical spindles—2 horizontal spindles and one tap head with 3 spindles. It is a six station machine for drilling—reaming—countersinking—counterboring and tapping operations.

If you are interested in equipment to meet specific job requirements, at a high productive rate, and at low cost—consult Morris. They have the engineering and manufacturing facilities and mechanical "know how" to help you.

Builders of MOR-SPEED Radials

The MORRIS Machine Tool Co.

CINCINNATI 3, OHIO

ESTABLISHED 1877

American Machinist

BURNHAM FINNEY, Editor

Primer for Prosperity

There is more and more discussion in business and industry about whether the country is in for a temporary recession in industrial operations sometime in the next six months.

Such a recession is not inevitable. If it should come, it will be man-made and not decreed by the gods. Everyone wants to avoid it.

We herewith offer six suggestions which we believe will go a long way toward staving off any serious dip and will allow us to continue without interruption our high level of industrial production.

1. *Set production schedules which are realistic.* Instead of attempting the impossible, manufacturers should control their output and their forward planning by the availability of the shortest item. If an automobile maker, for instance, finds that he will have more trouble getting radiators than anything else, then his production of finished cars in the months ahead should be determined by the number of radiators coming into his plant.

2. *Keep inventories under rigid control.* Not long ago it became the fashion in certain metalworking quarters to order as much as possible of all available items shipped in and stored. Total inventories soon rose to the highest point on record, and were the most unbalanced. Some manufacturers already have seen the folly of this practice and also the dangers. Now they are doing their best to bring inventories into reasonable bounds, and particularly to maintain them not too far in excess of the volume on hand of the shortest item in their line.

3. *Avoid strikes and other artificial blocks to continuous production.* While management now and then may assume a provocative attitude, the major responsibility for non-interruption of work rests upon union labor and its leaders. It is impossible to produce goods economically and sell them at a reasonable price at a profit as long as a plant is handicapped by an intermittent flow of materials and parts, largely stemming from strikes. In operation one day and down the next, working 40 hours one week and 25 hours the next, no factory can achieve low costs. And without low costs, low prices become impossible.

4. *Free from price controls all industrial products.* Many of the dislocations in our economy—shortages of parts and high prices—come from OPA's unintelligent handling of price controls as well as from strikes. Take a look at nails, pig iron, castings. This is an old story, but one which should not be overlooked.

5. *Recreate the desire to work.* To be sure, this is easier said than done. The philosophy that the world owes one a living has been preached so extensively in this country so long that it is hard to uproot it and replace it with the realistic philosophy that the individual and the nation make progress only by hard work. Our sole chance to keep high wages permanently is to increase productivity per man. High wages and doing half a day's work are incompatible.

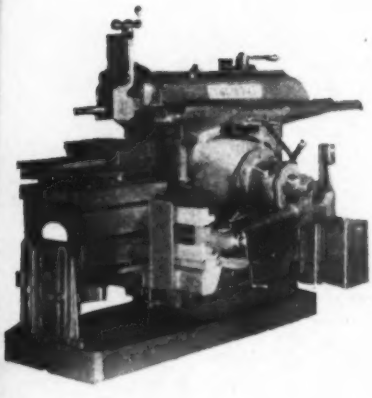
6. *Restore the proper balance between labor and management.* Whenever either labor or management has a distinct advantage over the other, it is stifling and injurious to the national economy. At present labor has the whip-hand. The legislative scales are balanced in its favor. Corrective legislation should be passed by Congress to effect the proper balance. If a start is made in that direction, it will be a distinct encouragement to industry and to the country. Fair play dictates an immediate start.

These six suggestions are not impossible of accomplishment. In fact, we are on the way toward doing some of them right now. If they are adopted and applied, we venture a guess that the chance of a recession in business will be more remote than a lot of people think.

Burnham Finney

THEY LIKE IT TOUGH

Courtesy of
Federal Engineering Co.,
Detroit, Mich.



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DEPRESSION IN '47?

...controls can bring one

IT IS CONVENTIONAL for the American business man, who values freedom, to protest against government regulation. On this account, many people who do not know the facts in detail are inclined to discount current business protests against the post-war application of wartime economic controls. This is particularly true since in his report for the third quarter of this year, the Director of War Mobilization and Reconversion implied that business is in fine health by remarking that "business profits, after taxes, are at the highest point in history."

In complaining about government controls, however, the American business man is not crying wolf. These controls were an essential war weapon. Now, however, they are contributing decidedly to a twisting and distorting of the American economy in a degree which, if not soon corrected, may well start production and employment down the toboggan.

One general indication of how badly twisted our economic system has become is found in the wide disparities in the amounts by which different groups of prices have increased. Since 1941, for example, farm prices have advanced an average of about 125%. Industrial prices, more tightly controlled than any other group except rents, have increased only about 32%. Meanwhile, straight time hourly earnings of industrial workers have gone up about 60% and the cost of living about 43%.

The advances of individual prices within these groups have also varied enormously. Among industrial prices, that of finished steel has gone up only about 14% since 1941, while lumber has gone up over 50%. Hourly wage rates in the women's garment industry have gone up 116%, while those in the brewing industry have gone up only 33%. That share of the cost of living due to rent has gone up only 4%, while that due to the cost of clothing has gone up over 60%.

Well, What Of It?

At least four things of major importance:

1. Production, under the influence of price control, has been heavily concentrated in some lines to the neglect of others. Result—unbalanced production, unbalanced inventories, and a serious cut in the flow of goods to consumers.

2. More or less uniform post V-J Day wage increases, promoted by the federal government, have imposed a far more serious cost problem on some industries than on others. This is particularly true of some of the most basic industries.

3. While, as a whole, "business profits, after taxes, are at the highest point in history" (due in part to a temporary excess profit tax rebate arrangement) there are enormous disparities in the profits of different industries. Some key industries are making little or no profits.

4. If not corrected, the distortion of prices, wages and production, which has resulted in such a wide disparity of profits, can contribute decisively to a major business upset.

The most striking example of the distortion of production by controls was, of course, that provided by a metropolitan meat famine at a time when beef cattle crowded the ranges. This has now been recognized. But there are many other distortions. Abundance of sports clothes, acute shortage of more essential clothing made from the same kind of cloth. Successive shortages of critically important products like baling wire and nails as the price lid on steel is jiggled first this direction and then that.

Some of these distortions of production are due to material shortages. But a major contributor is uneven application of controls, and the total removal of some while others are held firm. Among the results are bulging inventories of partially completed assemblies and shut-downs while waiting for parts.

Wage Complications

While price controls, unevenly applied, have shunted production first this way and then that, the federal government has further complicated the situation by promoting uniform wage rate increases without regard to varying capacities to pay them. The greatest single contribution to this distortion was made by the President himself. In the course of

unsuccessfully trying to mediate the dispute over steel wages last January he recommended a wage rate increase of 18½ cents an hour. Immediately that increase was accepted by organized labor as par for the first round of wage adjustments, having the sanction of the White House itself. The game then became to beat par.

But the capacity of different industries to pay wage increases varied greatly. During the war some had hiked their pay much more than others. Moreover, in some industries wages are a much larger element of total cost than in others. In 1939 (last year for which figures are available) wages ranged all the way from 2½% of total sales in cigarette manufacturing to 34.3% in hosiery manufacturing and 65.2% (for wages and salaries combined) in soft coal mining.

Under these circumstances, some industries were far less able to meet a uniform wage increase than others. Nonetheless, many of them had uniform wage increases imposed upon them. Then the price lid was held firm. This, coupled with material shortages and production difficulties which also choked output, squeezed the profit right out of those industries.

A Study In Contrasts

Some of the most important industries are making little or no profits while they bump along on a production volume which fails to meet consumer needs and prevents attainment of maximum efficiency. The automobile industry affords one conspicuous example. Another is electrical manufacturing, and rail equipment is yet a third. All of them are crucially important. Many other lines of business, of course, are extremely profitable. For example, the profits of a group of large retail stores were 150% higher during the first half of this year than they were a year ago; the profits of a group of motion picture companies were up 140%.

In the meantime, the workers in some of those low-profit industries are in no bed of roses. The increase in the cost of living since 1941 is now outstripping the increase in the hourly wage rate of workers in a number of industries, where wage rates have not risen as much as the average. On a weekly basis, a shorter work week, with less overtime, has combined with the recent upsurge in consumer prices, to place the living standards of some of these workers below the wartime level.

Such circumstances obviously create pressure in the ranks of these workers for another round of wage increases. But as long as the profit remains squeezed out of their industries wage increases, if any, must be translated either into higher prices, or, if the government sits tight on the price lid, into losses which will discourage production and ultimately cost workers their jobs.

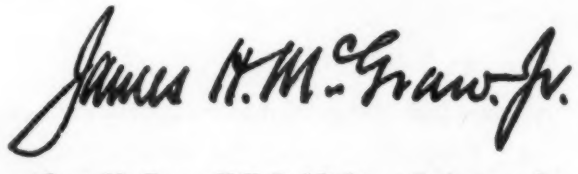
What To Do?

Salvation both for the workers and for employers in the relatively profitless section, a peculiarly important group of industries, must be looked for primarily by increasing productivity, thereby decreasing the cost per unit. Part of this higher productivity can come only from individual efforts of the workers themselves. Another part can come from an elimination of bottlenecks in materials and parts which prevent the labor force from working most efficiently. Only by greater output per man-hour can workers and management solve their common problem.

Until productivity has been thus increased, it is hard to think how the federal government could do a greater disservice both to labor and to industry than to repeat its performance of promoting a uniform national wage increase. With the present distortion of the national economy, some industries might again take such an advance in their stride. With many others it would raise even greater havoc.

While avoiding like the plague promotion of another uniform wage adjustment, the federal government must make it a primary objective to relieve distortions caused by the uneven application of other controls, primarily price control. Nature has given a lift to the elimination of distortions by providing bumper grain crops which should in time reduce that staggering disparity between a 125% increase in farm prices and a 32% increase in industrial prices. But that process must be speeded as a matter of conscious policy. No element of such a policy is more important than expediting the decontrol of industrial prices. Such a course is clearly essential to achieve that balance in the production of materials and parts required for maximum output.

Business and labor both want a sustained prosperity in which all will share. Sustained prosperity can be achieved only if we eliminate the distortions in wages, prices and profits which now restrain so much vital production.



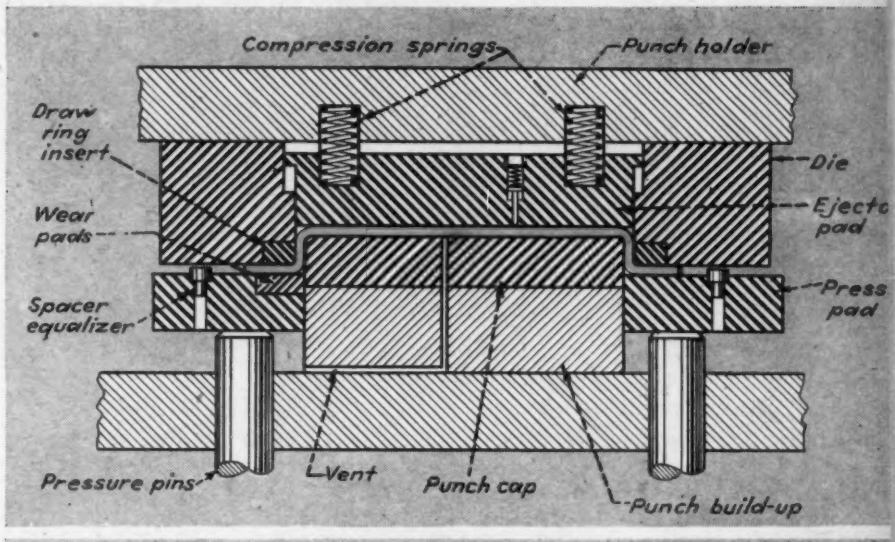
President McGraw-Hill Publishing Company, Inc.

THIS IS THE 52ND OF A SERIES

Tough Stainless Demands Rugged Tooling

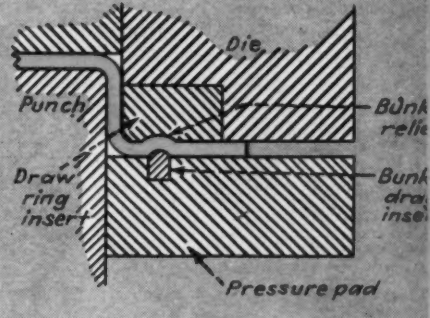
BY PETER HALLIN, ENGINEERING DIV., STAFFORD TOOL & DIE INC.

Press tonnage, ram speed, punch and die clearance and logical choice of die material decide success or failure of various press operations on stainless



TYPICAL SHALLOW DRAW DIE

As indicated above, the design of a satisfactory shallow draw die for stainless steel may be simple, following conventional standards plus greatly increased ruggedness. Bunker drags are useful at points where more drag is needed between draw ring and pressure pad to eliminate wrinkles



DESIGN of press tools for stainless-steel fabrication could be greatly simplified if engineers, designers and men responsible for methods and sequence appreciated more fully the character and limitations of the material. Products should be designed with practical and logical tool-up in mind and the dies and jigs designed specifically for stainless fabrication.

Drawing—In its ideal working state, stainless steel is as ductile as most mild steels of the deep-draw type. Only its toughness and tendency to "pick up" throw the onus on the toolmaker and designer. Draws of 40% reduction between anneals are commonly possible. Reductions as high as 50% can be made with good tools, but are not safe practice with a new set of dies.

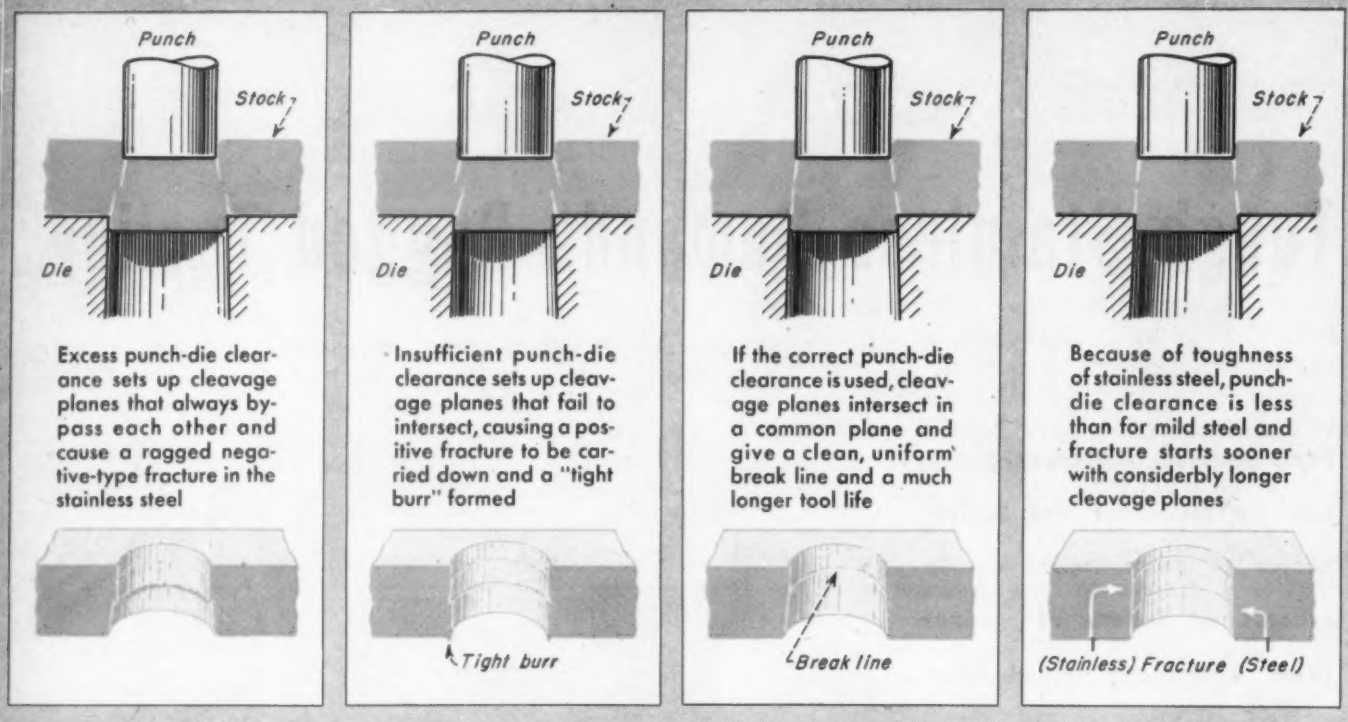
In selecting stainless steel primarily for ease of working, those alloys having molybdenum and sulphur or molybdenum and copper in combination as minor elements should generally be avoided. Carbon content above 0.2% makes deep drawing inadvisable. A higher carbon content increases work-hardening and requires more frequent annealing.

Annealing temperatures between 1850 and 1900 F. provide maximum ductility and corrosion resistance in 18-8 type stainless. Minimum annealing scale leads to successful die operation and economical die life. Oxygen-bearing compounds should be removed from furnace atmospheres. Dissociated ammonia (cracked) is a good fuel. Refrigerant dryers remove water vapor and give stock a better bright anneal.

A static rather than a dynamic stroke is desirable in both drawing and blanking stainless. A slow stroke gives the material being blanked a chance to set up its cleavage planes and impact shock is absorbed less abruptly and more uniformly, prolinging both press and die life. In drawing, a retarded stroke gives the steel a chance to go into its plastic state and flow into the desired form rather than being stretched. The drawing compound also adheres more uniformly to the metal.

Blanking—The punch, in blanking mild steel, should enter approximately 30% of stock thickness and the die should enter the stock the same amount from the other side. The metal is then in its compressed state, with cleavage planes set up. As the stroke continues, these planes extend in the line of least resistance and, if the clearance between punch and die is correct, they intersect in a common plane.

With stainless steel, this action is altered and the punch and die have less clearance. As punch-die penetration is reduced in stainless, cleavage planes are longer and a better break line results if the press action is re-


Punch
Stock
Die
Excess punch-die clearance sets up cleavage planes that always bypass each other and cause a ragged negative-type fracture in the stainless steel
Punch
Stock
Die
Insufficient punch-die clearance sets up cleavage planes that fail to intersect, causing a positive fracture to be carried down and a "tight burr" formed
Tight burr
Punch
Stock
Die
If the correct punch-die clearance is used, cleavage planes intersect in a common plane and give a clean, uniform break line and a much longer tool life
Break line
Punch
Stock
Die
Because of toughness of stainless steel, punch-die clearance is less than for mild steel and fracture starts sooner with considerbly longer cleavage planes
(Stainless) Fracture (Steel)

RELATIVE PUNCH AND DIE CLEARANCES

TOUGH STAINLESS DEMANDS RUGGED TOOLING (continued)

tarded slightly. A good rule for blanking and perforating stainless is to use 50% slower ram action and 50% more press tonnage.

New draw or forming dies should be put in a slow-speed press for a trial run if possible. Faults can often be discovered by observing the action of the stock. After the dies are running satisfactorily, they may be transferred to faster presses until a compromise between product quality and production demands can be reached.

In designing dies for press work, the high physicals of stainless should govern strength requirements. The die should be as heavy as one required for mild steel of approximately five gages greater stock thickness. Minimum over-all length in blanking and perforating punches should be stressed without sacrificing too much on their grinding life.

Punching — Sometimes perforating punches appear to be out of line because they throw a burr in piercing. If, on checking punch-die alignment, and parallelism of press and die set, no error is found, the fault is usually in the die design.

If a punch is weak it will bow slightly or skate just before entering stainless because of the toughness of the metal. In gang punching, one or two punches skating will drag all the others out of line unless they are staggered.

When a large number of holes are punched in a stainless-steel sheet, buckling sometimes occurs. This condition can be prevented by dividing the operation and hitting half the number of holes from one side and inverting the sheet before hitting the remaining holes.

Smaller perforating punches should have 1½ to 2 times standard shank diameter to absorb shock and reduce metal fatigue in the punch. Solid strippers with a slip fit on the punches for support and guidance should be used wherever possible in blank and pierce dies. Solid strippers are more positive than spring strippers and give less trouble.

COMPARATIVE DRAWING QUALITIES OF STAINLESS STEEL

AISI Type	Anneal, F.	Hardness Rockwell B	Drawing
301	2000	75	Medium
302	1900	80-84	Medium
303	1900	72-80	Fair
305	1900	75-85	Medium
309	1900	80-90	Good
316	1900	75-90	Good
410	1550	75-85	Fair
430	1550	78-90	Good
431	1300	250-Brinell	Doubtful
446	1400	80-90	Doubtful

Stainless steel requires about twice the spring pressure used for stripping mild steel. Because of the clinging action of stainless, stripping is often a source of failure. High polish of the punch walls and even line-of-action lapping facilitates stripping and reduces metal pick-up. A slight positive taper on punches gives an improved stripping action.

While shearing the punch or die may help to spread the load in blanking, shear of about 25 to 35% of stock thickness is adequate because of the toughness of stainless. Too much binds the stripping action and may even cause chipping of the cutting edge of the punch.

Die Materials—A number of materials have been tried for drawing rings; no one material is ideal for every job. The old standby, cast iron, holds its own in some cases and added strength is gained by small additions of nickel or chromium. Hardened tool steels are used for punches and on some die rings at high wear points because of their resistance to abrasive wear. However, these steels have a tendency to pick up particles of stainless, which must be removed by frequent stoning and honing. Tungsten carbide is used at wear points if shock and strain are not too great. Sizing or

redrawing dies, where wear resistance is essential, are typical applications.

Probably the most versatile and desirable material for deep-drawing dies is bronze, in its many alloyed forms. Bronzes having a high tin content are tough and have high strength; lead is desirable for antifriction; beryllium increases fatigue resistance; cadmium aids abrasion resistance and tellurium increases machinability. Recognition of the physical properties these minor elements impart is necessary in selecting the best type of bronze for the job.

A good bronze for general use in drawing rings is aluminum bronze containing more than 7.5% and less than 11% of aluminum. A recommended type, which can be heat-treated, contains 82% copper, 9.5% aluminum, 5% nickel, 2.5% iron and 1% manganese. It hardens at 1500-1600 F. by water quench and anneals at 700-1100 F., with a Rockwell B hardness of 105-106. An aluminum content of about 13.5% will give chisel hardness but is almost too brittle for practical purposes.

Machining operations on the aluminum-bronze series require certain tool adaptations. A high-spiral drill is most satisfactory, and the cutting edges should not be dubbed off. Spiral reamers having approximately 4° rake work well. An added rake on taps is desirable. Machining cuts should be heavy and uninterrupted, as aluminum-bronze work-hardens if the cutting tool is allowed to ride the cut.

An alloy of copper, zinc and aluminum (Kirksite) may be used for comparatively short-run form dies where the stainless is of light gage. They are economically cast and require little touching up after being taken from the molds. These castings are fairly accurate in relation to the original wood patterns, varying up to 0.010 in. depending on the size and uniformity of the cast shape.

Objections to Kirksite dies are their short life (between 1500 and 4000 pieces, depending on complexity of the form, stock thickness and physical state), and the tendency of zinc to adhere to stainless steel. This must be removed before heat-treating as it will cause hard or brittle spots.

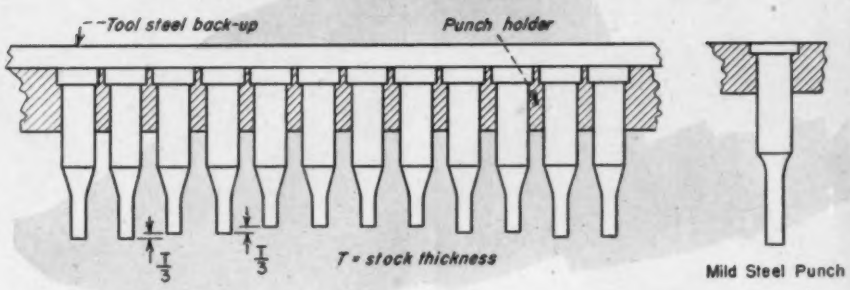
Drawing Compounds—Stainless steel requires drawing compounds of a much higher film strength than for mild steels. Contour of the draw, construction of the die, pressure that the draw ring operates on, press speed, material and its grain all must be considered in selecting compounds.

Basically, drawing compounds have the action of a separating layer or film between the material being worked and the die parts. This film is difficult to maintain because of the toughness of stainless steel and its resistance to plastic deformation.

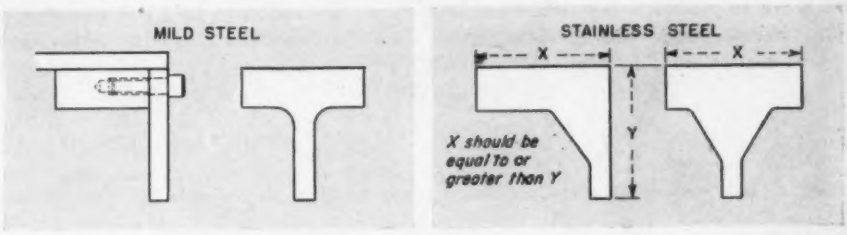
Film strength, determined by basic ingredients and alkaline saponification of the fatty materials used, is the most important requirement in selecting drawing compounds. Sulphurized or chlorinated compounds have high film strength and are desirable in the presence of frictional heat set up by press action. If the operation is so severe as to break down the lubricating films of these specialized drawing compounds, pigmentation may prevent metal-to-metal contact.

Several commercial drawing compounds adaptable to stainless-steel drawing have appeared recently on the market. Some of these, after being mixed with water, must be kept hot and agitated. To keep them in this state, converted washing machines have been used with success.

For light drawing operations, an oil mist blown in at the edges of the die has been practical. A standard air-oil lubricating unit is attached to the press and a feeder tube run to the die perimeter, where suitable outlets cover sheet and die as the ram descends.

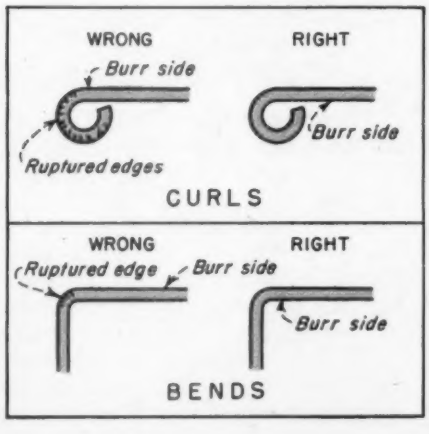


PERFORATING PUNCHES FOR STAINLESS STEEL. In a punch designed for stainless steel the head is heavier, the shank and punch plate thicker, and a taper rather than a sweep blends the tip to the shank. Besides being more rugged than mild-steel punches, a high polish is required on the tip diameter to facilitate stripping. Load is distributed by staggering the punch lengths



PUNCHES FOR LONG SLOTS. Maximum body and support are required for punching long narrow slots in stainless steel. Shearing the cutting edge of the punch also helps to keep slotting punches from springing out of line

IN BENDS, CURLS OR EXTRUSIONS, the burr side of the sheet should be on the side of minimum stress. Bends should be across grain or, if there are two or more bends at angles, the grain should run at an angle with both



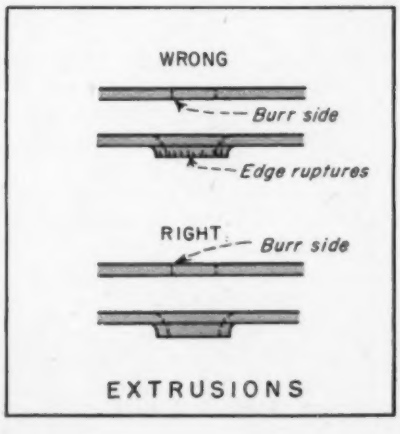
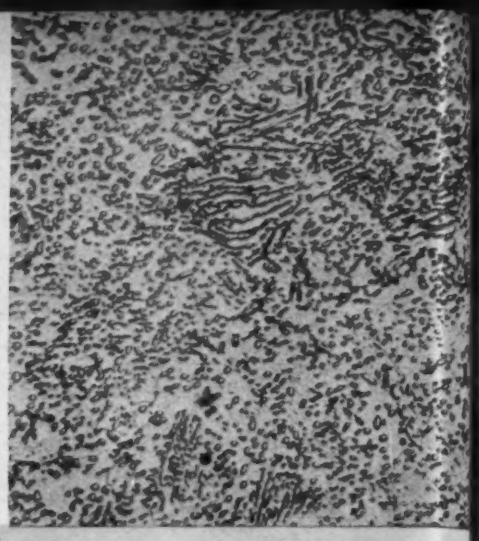


Fig. 1—Coarse banding and ferrite segregation in SAE 4620 upset forgings adversely affected finish when gear cutting. Mag. 100 X. Sample etched in 5% nital



Figs. 2 and 3—100% lamellar pearlite (left) was detrimental to tool life and finish when rough-machining SAE 3250 gear blanks. Re-annealing changed the structure to 25% lamellar pearlite and 75% spheroidized pearlite (right), a desirable condition when turning alloy steels with more than 0.45% carbon. Mag. 750 X, etch 3% nital

Machining Troubles Decline When the Metallurgist Sits In

BY NORMAN E. WOLDMAN, Ph.D.
CONSULTING METALLURGICAL ENGINEER, NORMAN E. WOLDMAN, INC.
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BENDIX AVIATION CORPORATION

MACHINABILITY may be defined as the relative ease with which a material is cut by sharp tools in various operations, or it may be said that the most machinable metal is the one that permits fastest removal of the greatest amount of material per grind with satisfactory finish. In their approach to machining problems, many manufacturers and machine shops pay much attention to tool design and changes in cutting speeds, feed and depth of cut, but overlook metallurgical factors characteristic of the material being machined. This failing may be entirely a result of lack of knowledge of the relationship between machinability and metallurgical factors of the material.

For Broader Viewpoint

So many factors affect machinability of metals that often a problem cannot be solved without full cooperation of the tool design, production and metallurgical departments. Each department will naturally approach the problem from its own experience. Yet, the viewpoints of all departments can be sifted until the correct solution is obtained.

The large number of recognized factors which affect machinability can be seen from the four groups tabulated:

Material Cut
- Chemical composition
- Melting and casting process—grain size
- Fabrication — cast, forged, drawn or rolled
- Heat-treatment — normalized, annealed, quenched and tempered
- Microstructure
- Mechanical properties — tensile strength, ductility, hardness
- Size and shape

Cutting Tool Used
- Material composition
- Heat-treatment
- Hardness and strength
- Design, form and shape

Machine Tool
- Rigidity of tool and work-holding device
- Condition of cams, bearings, alignment
- Feed, speed, depth of cut

Cutting Oil
- Type of oil—sulphurized mineral, lard or water-soluble
- Cooling properties

It is agreed that the tool designer or the setup man—or even the machine operator—can and has solved machining problems by juggling with changes in feeds, speeds and depth of cut, or the rake angles on the cutting tools. But these cut-and-try methods may be minimized if metallurgical factors are known.

There are three aims in improving machining: (1) increased machining speed, (2) good tool life and

TOOL GRINDS and setup are not the final answer; using the same tools, it is possible to get much better finish and more pieces per grind by relating microstructure to the operation

(3) satisfactory surface finish. Metals which give best results in milling may not be in the best condition for drilling, broaching or turning. Likewise, steels which give best results in rough-cutting operations in the automatics may give poor results in gear-cutting or broaching operations where light cuts are taken. Again, steels which have the best microstructure for optimum machinability may tend to enhance distortion during subsequent heat-treatment, which means that sometimes machinability must be sacrificed.

During the war, when high production and minimum rejections were mandatory to meet delivery dates, one aircraft-accessory manufacturer recognized the value of metallurgy in preventing machining troubles. Hence, a closer relationship was established between the metallurgical, tool design and production departments. By controlling the raw material coming into the plant through rigid material specifications and close laboratory tests for hardness and microstructure, the metallurgical department proved a great aid in getting maximum machinability of the material being cut, plus decreased rejections arising from improper surface finish.

Below are cited a number of cases in which the metallurgical factors, characteristic of the purchased material, caused machining troubles, and how these problems were solved by changing these characteristics.

Case No. I

Poor finish was obtained in cutting the teeth on SAE 4620 steel gears on Fellows gear shapers. Surfaces were rough and torn. Micro-examination showed coarse banding and ferrite segregation in the upset forgings (Fig. 1). Free ferrite is soft and easily deformed so it tears away from the stock, leaving a rough surface. It also adheres to the cutting edge, creating excessive frictional heat and drawing tool temper. It also has a tendency to weld to the edge of the tool, producing a large built-up edge. Forgings were renormalized with more rapid cooling through the critical range. This treatment broke up the banded structure and ferrite segregation and increased hardness from 143 - 149 Brinell to 159-170 Brinell. The forge shop was advised to change its normalizing cycle accordingly on future orders, so the trouble did not occur again.

Case No. II

An unsatisfactory finish was obtained in cutting the pinion teeth of SAE 3120 plunger shaft on a Fellows gear cutter. Microexamination disclosed a uniform annealed structure with no banding and no ferrite segregation. Grain size was large and hardness was low, namely 150 Brinell. By oil quenching and tempering shafts to 229 to 248 Brinell, finish on the teeth was greatly improved. Smaller grain size and higher hardness produced the desired high surface finish. Standard 18-4-1 high-speed steel was used for the cutters.

Case No. III

Short tool life and poor finish were obtained in rough-machining SAE 3250 gear blanks on Bullard Mult-Au-Matics. Forgings were ordered as normalized and spheroidize - annealed. Microexamination showed practically 100% lamellar pearlite. Hardness was 197 to 229 Brinell. Forgings were re-annealed at 1375 F. for a number of hours and furnace-cooled. This treatment changed the structure from a 100% lamellar pearlite to a 25% lamellar pearlite and 75% spheroidized pearlite. Hardness dropped to 174 to 192 Brinell. Machining proceeded without further difficulty. Alloy steels over 0.45% carbon machine best in the spheroidized condition on rough-cutting operations. This was set up as a standard for all rough-machining of alloy steels of more than 0.45% carbon content. Fig. 2 and 3 show, respectively, the undesired lamellar pearlite and the desired spheroidized pearlite for optimum machinability in rough-cutting operations.

Case No. IV

The reverse is true in gear-cutting operations. Poor surface finish was obtained in cutting a lot of SAE 3250 armature shaft pinions on the Fellows gear cutter. Microexamination showed a completely spheroidized structure (Fig. 3). Although this structure is satisfactory for optimum machining of rough blanks from bar stock in automatics, it is the poorest structure for light cuts taken on gear cutters. These rough-machined armature shafts were box-annealed at 1600 F. and furnace-cooled to produce a laminated pearlitic structure (Fig. 2), after which the parts were machined satisfactorily.

Case No. V

Short tool life was encountered in cutting external splines. Parts were made from SAE 2515 steel, carburized all over, with the case machined off at section where splines were to

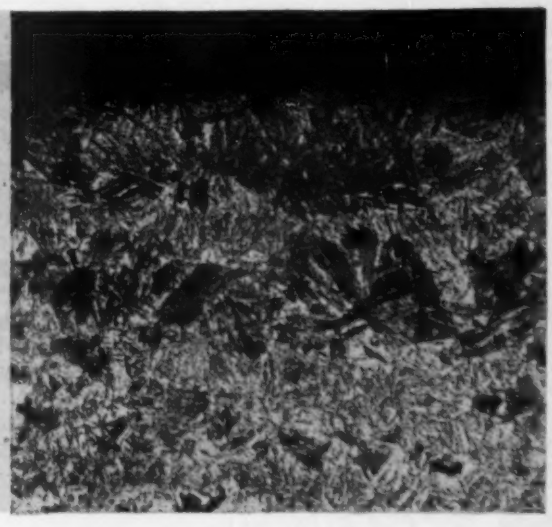


Fig. 4—Hard martensite in a carburized case can be transformed by a low-temperature anneal (1250 F.) for 2 hr. and furnace cooling. Mag. 100 X, etch 3% nital

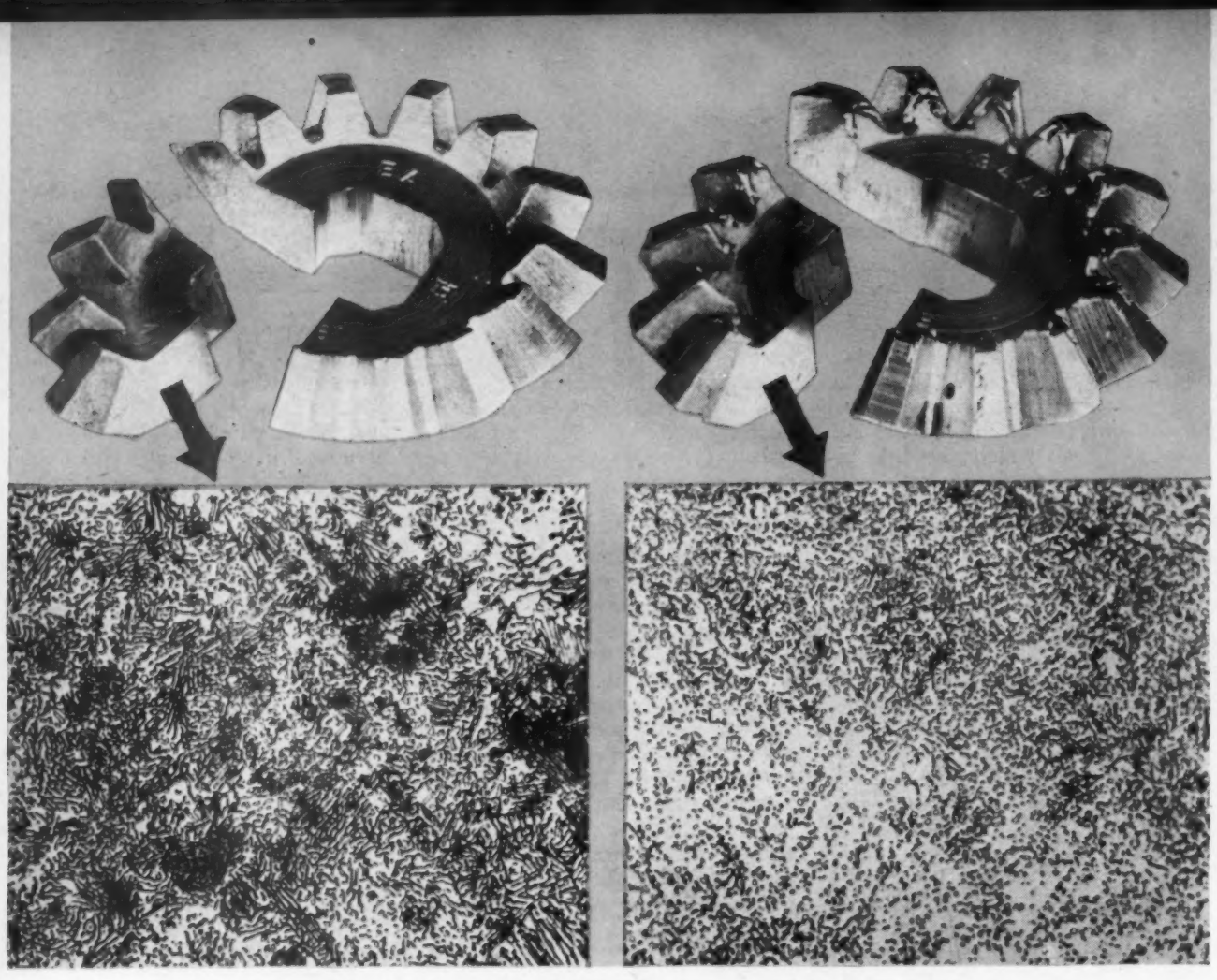


Fig. 5—A cycle anneal of SAE 4350 bevel-gear blanks produced a lamellar pearlitic structure (left), giving better finish on the teeth and eliminating burring. At right can be seen the original spheroidized structure and the poor results obtained in gear cutting

be cut, then hardened by quench and temper. Hardness tests on the noncarburized area in the core showed 43 to 45 Rc, a high hardness because carbon content of the purchased material was at the upper end of the range. The ends where the splines were to be cut were induction-tempered to about 35 Rc average, after which they machined satisfactorily.

Case No. VI

Difficulty was encountered in tapping clutch spring nuts made from SAE 3135 steel and hardened to 34 to 38 Rc. Examination showed satisfactory microstructure and hardness. Nuts were put in the furnace and retempered for two hours at 800 F., about 100 F. lower than the regular tempering temperature used after quenching. No change in microstructure or hardness was evident, but there was definite improvement in ease of tapping. Often a retemper of a heat-treated steel will improve machinability, although no change in structure or hardness is evident. A high-temperature, short-time temper will produce incomplete transformation in spots, thereby making machining more difficult.

Case No. VII

Poor tool life was reported on semi-finish machining of intermediate heads for a starter on hand screw machines. Parts were made from SAE 2515 steel, rough-machined, carburized and furnace-cooled. The operation causing trouble consisted of machining off part of the carburized case before hardening. Hardness of the case varied from 26 to 33 Rc. Microexamination of a hard spot showed presence of martensite (Fig. 4). Parts were given a low-temperature anneal at 1250 F. for 2 hr. and furnace-cooled. Hardness was then 26 to 38 Rc all over, and parts could be machined satisfactorily. Martensitic areas can be broken up by a low anneal, also called a high tempering treatment just below the AC_1 point.

Case No. VIII

Threaded sleeves for a combustion starter showed poor finish after spline-hobbing on Barber-Colman machines. Parts were fabricated from SAE 2515, hammer-forged bar steel. Hardness tests showed 83 to 93 Rb, equivalent to 152 to 197 Brinell. Parts were heat-treated by oil quenching from 1500 F. and tempering at 1050 F. to 22 to 24 Rc. Hobbing then produced satisfactory finish.

Case No. IX

In cutting bevel gears (Fig. 5), trouble was encountered with poor finish and marked burring. The latter fault required an extra operation in deburring. Besides, the inspection department refused to pass the gears because of the torn surfaces on the mating faces of the teeth. Micro-

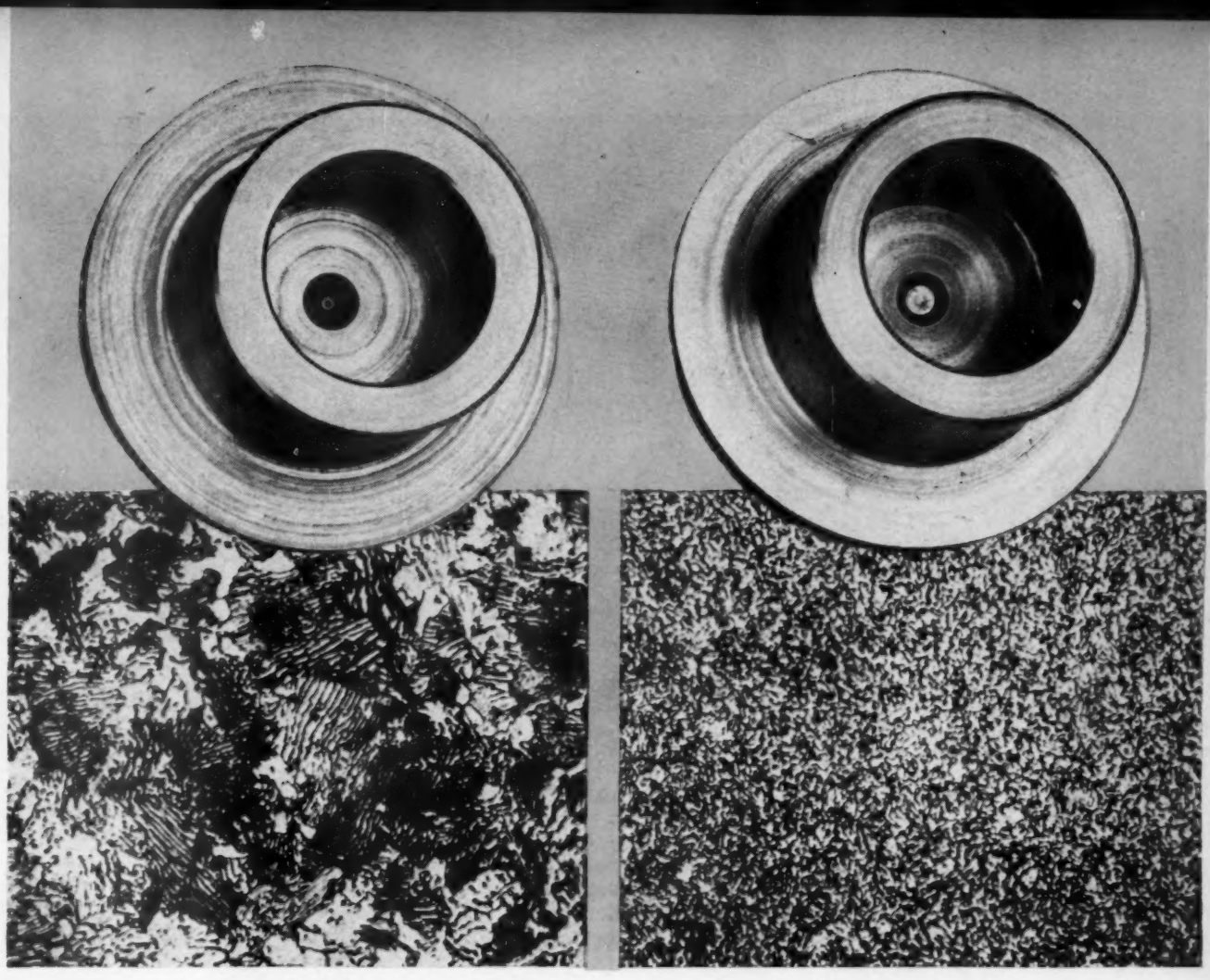


Fig. 6—*Left*, torn finish on a SAE 6150 starter jaw machined on an automatic is directly related to the lamellar pearlite structure below. *Right*, by annealing to obtain a spheroidized structure, smooth surface finish was secured

examination showed a completely spheroidized structure of the SAE 4350 steel. The steel machined well in the automatics but poorly in the gear cutters. The gear blanks were cycle-annealed to produce more of a lamellar pearlitic structure. When teeth were cut, no burring resulted and an excellent surface finish was produced.

Case No. X

In hobbing teeth in the sector worm wheel of a sextant-frame assembly on a Barber-Colman machine, the plant was able to get only 5 pieces per tool grind. This was a critical machining job, because several light cuts had to be made and the surface finish was critical. Parts were made from bronze chill castings of 10% lead, 10% zinc, 80% copper. By nitriding the cutters, production was increased to 14 pieces per tool grind.

Case No. XI

In machining NE 8630 and NE 8635 steels, trouble was encountered. Microexamination showed that material obtained from warehouses always showed a partial or completely spheroidized structure. It had been well established that alloy steels of less than 0.40% carbon content machine best in all operations when the structure is of lamellar pearlite rather than of spheroidized pearlite. This is especially noticeable in thread cutting, gear cutting, broaching and any finishing operation.

Case No. XII

Starter jaws made from SAE 6150 steel showed a poorly machined surface and low tool life after machining on a New Britain-Gridley. Microexamination disclosed a lamellar pearlitic structure. Spheroidizing by a long soaking anneal just below the Ac_1 point produced a structure which gave excellent surface finish and also increased the tool life. Fig. 6 shows at left the lamellar pearlite structure and the torn surface finish, while at the right is seen the spheroidized structure and the smooth surface finish on the starter jaw.

Case No. XIII

In finish-cutting internal gear teeth on an internal sun gear on a Fellows gear cutter, only 3 to 4 pieces could be produced between grinds. Parts were of SAE 3250 steel, rough-machined, hardened to 42 to 46 Rc, then the internal gear teeth were cut. Replacing the regular grind of the cutters with a smooth grind increased the rate to 6 pieces between grinds. A smooth grind and a lap increased the rate to 9 pieces between grinds. Nitriding the smooth ground cutters, followed by another light grind, increased the rate to 24 pieces between grinds.

Case No. XIV

Jaws (Fig. 7) for aircraft starters are made from either SAE 6150 or SAE 4350 steel. Excessive burring and poor finish were always obtained on the tooth-cutting operation when the material was in the spheroidized condition. The structure is converted to lamellar pearlite by these steps: A box anneal of the blanks by pack-

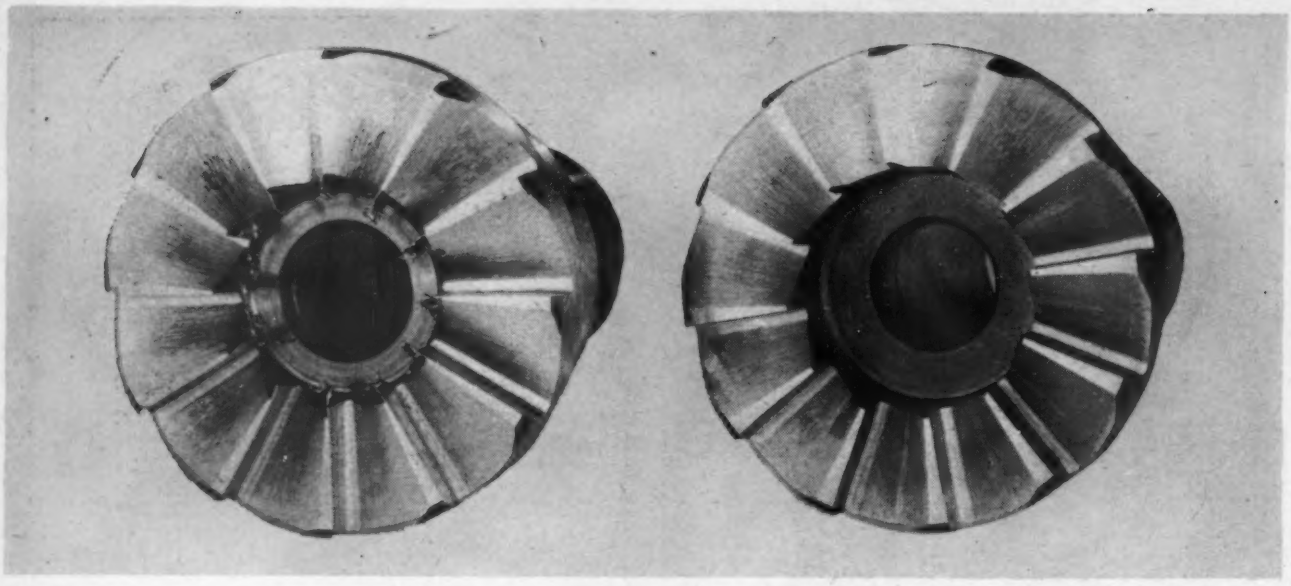


Fig. 7—Tool changes are not the answer when poor finish and burring are encountered in gear cutting. Starter-jaw forgings with spheroidized structure gave poor results (left); with the same tools but after annealing the blanks, satisfactory pieces (right) were produced

WHEN THE METALLURGIST SITS IN (continued)

ing them with cast-iron chips in a box, heating to 1575 to 1600 F. for 3 hr. at temperature, cooling to 1100 F. at the rate of 150 to 250 F. per hr., then cooling to 700 F. at a rate of 200 to 300 F. per hr. (SAE 6150 steel need not be slowly cooled below 1100 F.) and finally to room temperature; or a cycle anneal by heating the packed container to 1575 to 1600 F. for 2 to 3 hr. at temperature, cooling to 1100 F. at a rate of 300 to 1000 F. per hour, reheating to 1250 to 1275 F. for 2 to 3 hr. at temperature, then furnace cooling. Finish is greatly improved, and practically no burring results.

Only some machining problems are of a metallurgical nature. These are essentially cases in which hardness, composition or microstructure of the material being machined, or type, composition and quality of the cutting tool, are involved. Here, an investigation by a metallurgist and subsequent setting up of proper metallurgical control are vital in preventing future machining troubles and reducing machining costs.

But where no machining trouble has been reported, there are numerous instances for which a thorough metallurgical examination of a machining job will indicate ways and means by which a change in material, composition, prior heat-treating, or improved microstructure will permit reduction of machining cost.

From the standpoint of the cutting tool used, the metallurgist can also help in selecting the right grade of cutting tool and setting up quality control on the tools used. Because of this knowledge of cutting qualities of the various materials machined, a metallurgist can often advise on the best feeds, speeds, depth of cut and rake angles.

The relationship of microstructure to machinability has become an important phase of metallurgy, and the constant attention of a metallurgist, trained and experienced in this type of work, has been thoroughly justified in the reduction of machining costs.

PLASTICS CENTRIFUGALLY CAST

IRON, steel and aluminum parts have been centrifugally cast for a number of years with outstanding results. Newest application of the process is the forming of plastic housings, handles, knobs, distributor adaptors, pushbuttons, film reels, switch controls and radar parts. All of these have been cast experimentally, not as yet on a production basis.

Formerly, casting plastics by other methods has been confined to simple contours because of the danger of trapped air bubbles and weak sections. Centrifugal casting eliminates this and provides results that could otherwise be obtained only by molding.

Phenolic resin, along with pigments and fillers, is thoroughly mixed and poured into the mold which should be able to stand curing temperatures of 160 to 290 F. Centrifugal forces for the removal of air bubbles are created by spinning the resin-filled mold with a slightly modified drillpress, at the same time providing a heat for the cure. The cycle at the present time is from 1 to 4 min. depending on part specifications.

Flash is thin and may be removed by hand tools, where quantity does not warrant finishing fixtures. Special cores may be used for hollow castings. Centrifugally cast parts may contain inserts, threaded holes, sharp contours and thick sections.

The cost of molds is low and the process is ideal for the development of products which may later be transferred to standard high-pressure molding equipment for mass production. In time, and with further development of centrifuges, the process may be practical for high production. In the meantime it provides a practical means for experimenting with plastics to those metalworking companies who do not have standard plastics equipment.

OBJECTIVES for Foremen

BY DAVID T. ARMSTRONG

FOREMEN should take time out now and then to consider their long-term goals and evaluate their short-term policies in connection with the industrial programs of their companies. By striving to improve company operations, foremen bolster their own job security and also that of the men with whom they spend so much time at work.

A foreman's responsibility embraces a multitude of functions. He is charged with contributing towards making the plant a better place in which to work. Not the least of his duties is constant attention to physical cleanliness within the plant. Everyone likes cleanliness, although not everyone will work equally hard to achieve it.

It is up to the foreman to emphasize the importance of keeping a machine or work station clean. Sometimes his discussion on the subject must be made tactfully, but he should not deviate from a consistent policy of having those under him cooperate in plant cleanliness.

Most workers refrain from wasting their own resources, but have a different attitude about materials in the shop. The product is there in such abundance a careless attitude can grow up unless a foreman is scrupulously careful about this point.

Turning out unnecessary lights, turning off the motor on a machine that is going to be idle for a short time, respect for supplies and equipment, and all such little things mount up in cost when many workers are involved.

These are things the average foreman often hesitates to talk about. If a blanket castigation of workmen is made, the earnest, conscientious men generally feel bad about being included. Without being a prude or a pennypincher, it is possible to appeal to the fundamental good in most workers by the power of example, plus a timely remark to an erring individual guilty of waste.

In keeping the interests of his company at heart, a foreman can retain his value for leadership and maintain his own security

It is sometimes wiser to refrain from focusing attention on an individual at the time he has made a blunder. It is better to wait until the incident has passed and then, during a friendly chat, point out ways in which waste can be cut. Let the worker come to the conclusion there are probably ways in which he can help cut waste. Men are better persuaded by reasons which they have discovered by themselves than by those revealed to them by someone else.

Too often the experimental demands of research workers or production managers receive scant attention from foremen. Antagonisms develop which may be costly to the company when the foreman does not give his wholehearted interest and attention to the teamwork necessary in any cooperative manufacturing enterprise.

For example, the foreman in a large food-processing plant devised a plan for improving the processing time of a soup which eventually was to be sold as a dehydrated product. He did not pass his idea along, however, because he didn't want research men to make trial runs and interrupt the normal, trouble-free routine of his department.

The idea finally did get out through a suggestion made by one of the workers and it was discovered that the new method improved the flavor in addition to decreasing the processing time.

The foreman lacked the simple principle of doing everything possible to make his company a better organization. He missed the opportunity of being acclaimed a leader; he would have felt better himself for having contributed something in the interests of his company, and in turn would have boosted his own personal stock.

There is another way of looking at this same problem. Suppose a foreman owned stock in the company for which he worked. Wouldn't it be to his advantage to do everything in his power to put his company in a position to be able to pay dividends to its stockholders? Isn't that one of the deciding factors in the public mind when a company's reputation for dependability is evaluated?

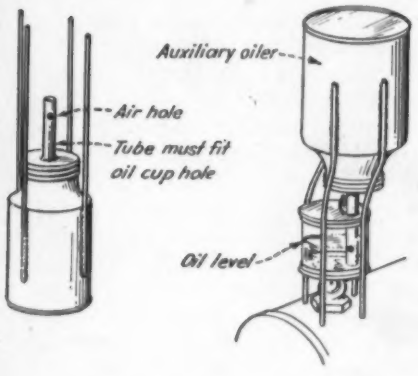
For the foreman who isn't a stockholder (and this is the large majority), it might be well to judge his policies and decisions on the basis of how much they help the company to run its business and assist it to continue to pay dividends on the principle of an ever-increasing spiral.

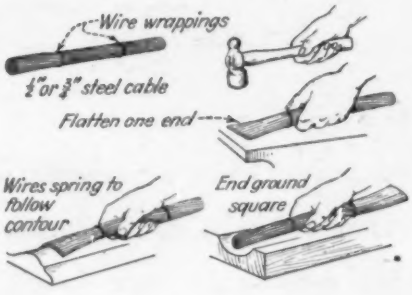
Objectives such as these are not policies that can be formulated, announced, then carried out automatically. They are rather a standard by which each foreman and supervisor must learn to gage his judgments, decisions and actions. To achieve the long-term goal of making a company a better place in which to work, the simple philosophy of these paragraphs must become inherently a part of the foreman and his crew of helpers.

Short Cuts FOR THE SMALL SHOP

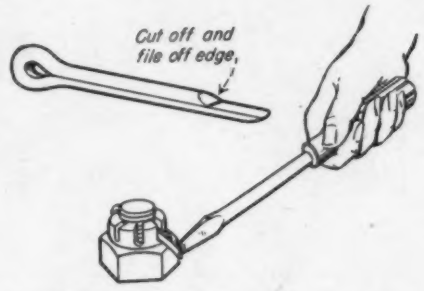
BY A. H. WAYCHOFF

SIGHT-FEED OILERS that are likely to run dry because equipment operates for protracted periods without attention can be equipped with an auxiliary oiler at little expense. Secure a one-pint screw top can. Make a spout from a piece of copper tubing that will enter the filling hole in the sight-feed oiler. Drill a small air hole in the spout about ½ in. from one end. Solder the other end to the screw top. Finally, solder four wire legs to the can. Fill the can with oil, invert over the oiler, slip the spout in the hole, and bend the legs so that the can stands in proper position and with the end of the spout near the bottom of the sight-feed oiler. Oil will run out of the spout until the air hole is covered. As the equipment consumes oil, the air hole will be uncovered and the oil will again flow into the oiler until the air hole is reached. Thus, an adequate supply of lubricant is maintained in the oiler until the auxiliary can is exhausted.

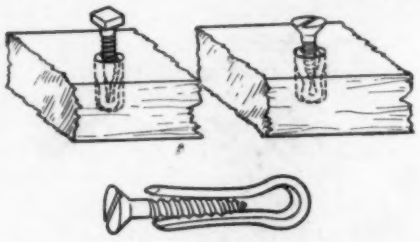




A SCRAPER that conforms to various work contours is a handy device when removing paint or rust. Secure a piece of ½- or ¾-in. steel-wire cable such as is used for guy wires on electrical poles. Cut off a piece about 8 to 10 in. long. Wrap several turns of fine wire around the cut piece at two points about 1½ in. from the ends. Grind one end square; hammer the other end on an anvil until the wires are displaced fanwise. This end works well as either a flat or contour scraper. The wires will bend to maintain contact with flat surfaces or reach into depressions or channels.



COTTER PINS are easier to spread in awkward places, if one leg is cut short approximately ¼ in., and the cut end is beveled with a file. This makes the pin much easier to insert in a place hard to get at. When inserted, a push against the long leg will secure the cotter. This stunt overcomes the problem of spreading equal legs in places difficult to reach.



EXPANSION ANCHORS in light work can easily be made from a lag or wood screw and a cotter pin. Spread the legs of the pin and insert it head down in the hole. Then insert the screw.

TIPS for Top Shop Men

132 Basically, the difference between salvage and conversation is the difference between collecting scrap and preventing it. Before you're proud of the salvage total of your department, determine whether some of the scrap might have been avoided. Everybody makes mistakes, but there's no need to have equipment or methods as contributing factors. And there may be a way to use a smaller piece of stock where the scrap is turnings or trimmings.

133 One of the old theories was that a foreman and a cop had something in common. When foremen got uniforms, the illusion was heightened—except that they swung privileges instead of clubs. But now we've trying to educate cops out of the bossy, superior attitude. Take a tip from the police—get down off your high horse if you're on one.

134 Cops have long considered it their God-given right to pilfer edibles from merchants on their beats. Maybe that's where the word "deadbeat" came from. Some foremen have long exercised a similar "right" over cigarettes, candy or ideas left exposed. But it's not a right—it's a racket, and is considered as such by the victim.

135 Don't flaunt your authority or your privileges. A foreman should have both, but in reserve. They're as dangerous as a loaded pistol in the hands of a kid playing cowboy if they're waved around as evidence of ability. The ability should show without advertising.

136 Be sure men work *with* you, not *for* you. Being a BOSS is only protection for your own stuffed shirt that can be seen through and worked through. If all you've got on the ball is authority, you'll get strikes (official and unofficial) aplenty, but the wrong kind.

Helpful Hints in Ordering Heat-Treatment

Manufacturers planning to use commercial heat-treaters can speed their orders through by providing specific instructions

MANUFACTURERS using or planning to use commercial heat-treatment shops can assist in overcoming delays by accompanying their orders with specific data required by the heat-treater. Telephone calls and letters seeking supplemental information on the material being worked can be eliminated and the finished order can be delivered much more swiftly.

The type and brand name of the steel to be heat-treated is an important specification. This provides ready analysis of the material and guides the proper heat-treatment procedure. SAE or NE numbers are sufficient as they are designed to indicate the composition.

Hardness or physical properties required is essential. This is particularly important when two or more hardness ranges are required on the same part, as in the case of collets and cam shafts. Drawings or work must always be marked clearly, showing the area and its required hardness.

In listing general specifications, operations to be performed must be specified. For instance, whether the work is to be annealed only, or hardened and drawn, or perhaps normalized. Also, it should be designated whether a sand blast or other finishing operation is required.

Straightness tolerance, if given, lets the heat-treater know how much stock is left for removal after heat-treatment. If there is 0.030 in. of material left on a side, it is senseless and costly for the heat-treater to keep within a 0.003-in. straightness tolerance.

Designation of selective or overall heat-treatment is essential. Which part is to be hardened (if it is a selective hardening job) must be shown clearly. If not, the simple note "harden all over" should be put in.

A simple description or sketch of the part often helps eliminate confusion and possible loss of small parts. It also enables the heat-treater to maintain standard procedure records for each individual part.

Billing and shipping instructions should appear on shipping tickets and packing slips, as purchase orders are often late in arriving and cause shipping delays.

It is advisable to include the name of a person in the company who can readily supply any further information which the heat-treater might require for special jobs. It will save time if the heat-treater knows beforehand who can give him the necessary data.

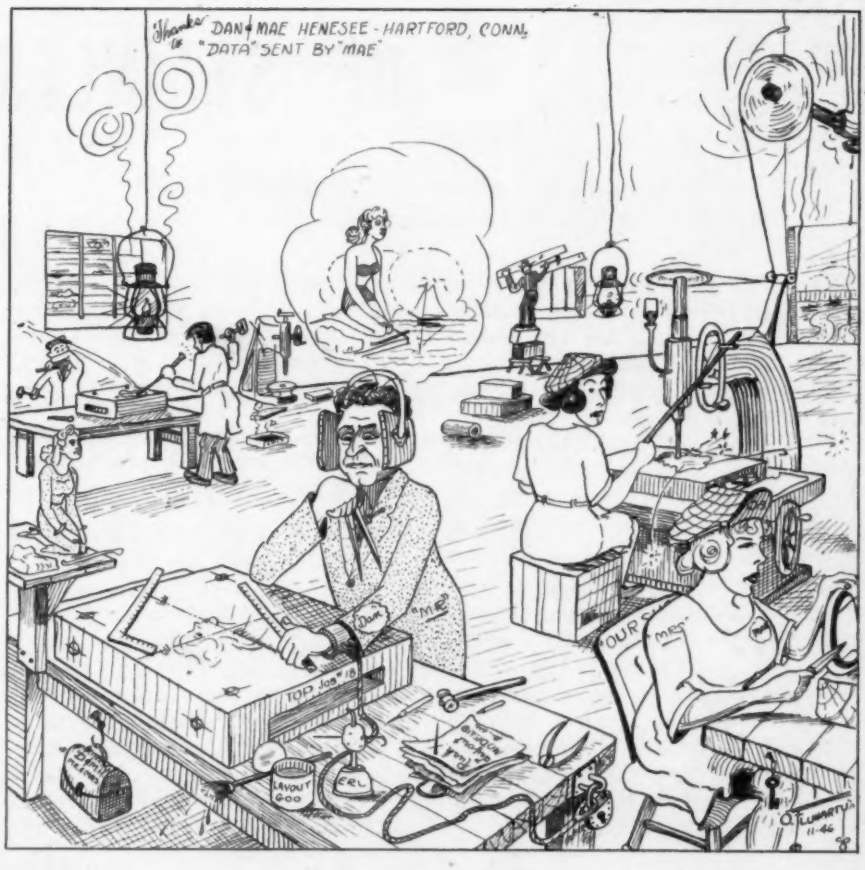
If these points are carried out by the manufacturer in ordering heat-treatment from outside shops, they will work to the mutual advantage of the heat-treater and customer.

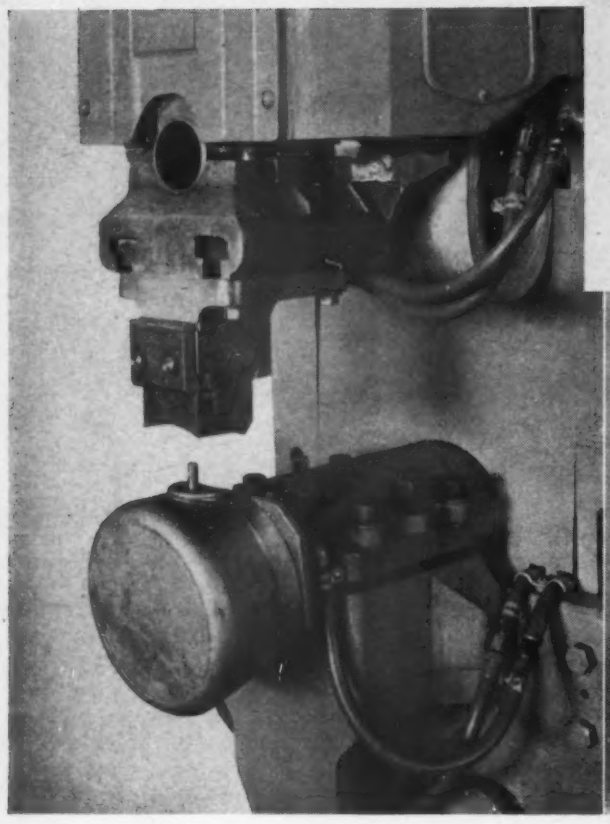
(Editor's Note: These suggestions in connection with ordering heat-treatment are included in a heat-treating service manual compiled and published by the Metal Treating Institute, scheduled to be made available in the near future.)

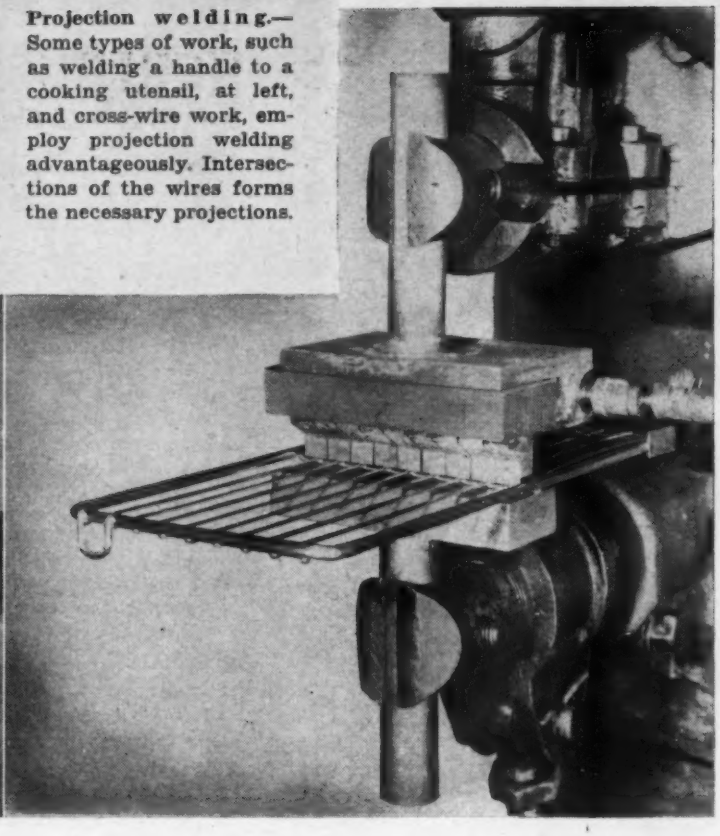
For Greater Die Output

ONE OF THE AUTOMOBILE toolrooms has been reorganized to an often-critized layout: machines in the center, benches around the walls. Purpose of the move is to provide more space for an influx of appren tices, upgraders and semi-skilled operators. The management realizes it must handle a three-fold increase in manhours in order to get out its share of a greatly increased die program for the 1948 models.

OUR SHOP . . . 13 — *Ball & Chain Dept.*







Projection welding.— Some types of work, such as welding a handle to a cooking utensil, at left, and cross-wire work, employ projection welding advantageously. Intersections of the wires forms the necessary projections.

RESISTANCE WELDING OF STAINLESS STEELS...1

Spot and Projection Welding

This tough metal requires rigid control of cycles, practical selection of equipment and a healthy regard for physicals

BY J. J. RILEY
Welding Engineer
Taylor-Winfield Corporation

STAINLESS STEEL may be spot-welded efficiently and economically if welding variables are recognized and related to properly selected and properly rated equipment and welding technique chosen to suit.

The many varieties of stainless steel, based on their metallurgical structure, are placed in three groups Approximate welding characteristics of these groups are:

Martensitic—straight chromium. Difficult to weld and tends to become hard and brittle. Postheating the spot weld in the welder could undoubtedly give favorable results.

Ferritic—straight chromium. Not so difficult to weld unless welding heat causes grain growth and embrittlement. This can be minimized by using short weld cycles.

Austenitic — chromium - nickel. Will weld, but only with proper technique, rigidly controlled.

In spot-welding, a localized zone of metal between the electrodes is raised to a molten condition. Another zone, concentric with this and in the plastic state, prevents molten metal from being expelled. Because of the fluidity of stainless in the molten state, transition from plastic to molten metal is abrupt and requires precise control of heat. If heat is not sufficiently controlled, metal will be expelled from the weld and cause a loss in strength, a possible cavity in the weld and excessive indentation of the electrodes into the metal in an attempt to close the cavity.

Less current is required for spot-welding stainless than for low-carbon steel because of the greater electrical resistivity and characteristic oxide film.

At elevated temperatures, com-compressive strength of stainless

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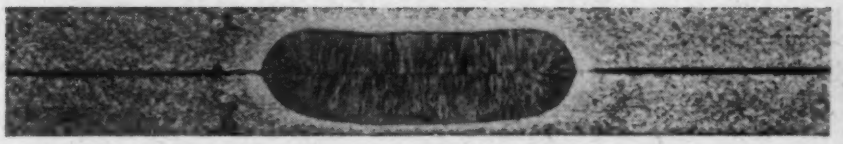
The Spot Welding of SAE 1020, 1035 and 1045 steels in 0.40-in. thickness—W. F. Hesse, D. C. Herrschaft, Welding Journal, *Oct., 1943.*

is higher than that of low-carbon steels, so greater electrode force must be used. Copper-alloy electrodes, having about 45% the conductivity of copper, give longest tip life. Electrode temperature should be kept low by water cooling.

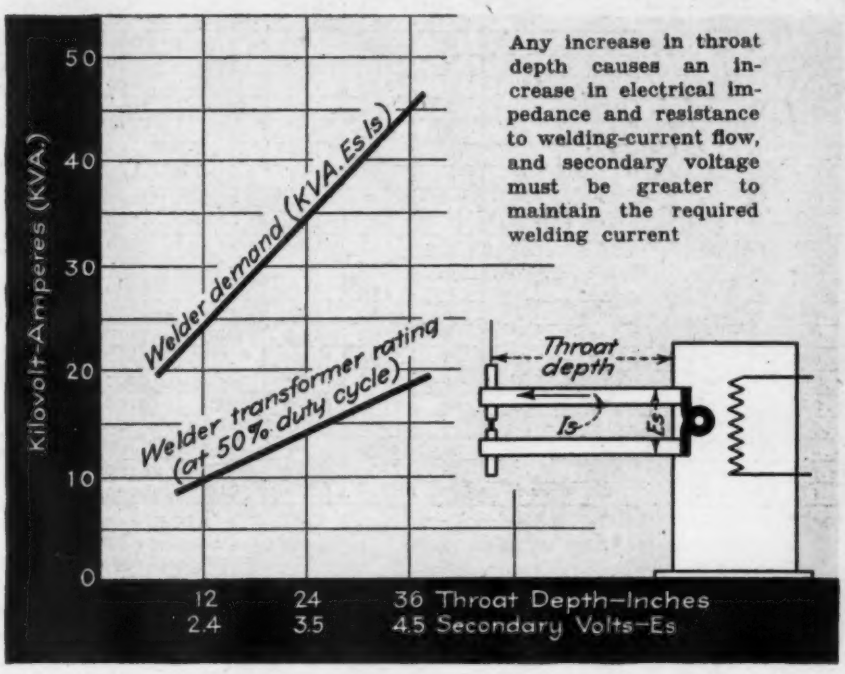
Just below the welding temperature of stainless, there is a secondary sensitive temperature range. Time of current flow should be decreased until the temperature gradient between the molten metal in the weld and the surrounding metal is so steep that any dwell in the weld, or in the undesirable temperature zone, is at a minimum.

In welding the thinner gages of stainless, it is easier to prevent harmful effects in this secondary sensitive range. When the thicknesses approach 0.125 in., it is almost impossible to avoid either grain growth or carbide precipitation, unless a columbium- or titanium-stabilized steel, or one with an extremely low carbon content is used.

Distortion and stresses from actual weld shrinkage will be most severe in chromium-nickel steel because of its greater coefficient of expansion and lower thermal conductivity. Because of the shrinkage factor, more spot-welds of smaller



THE SPOT-WELD NUGGET may be measured by cutting a sample through the middle, polishing and then etching it in 10% oxalic acid or in a hot solution of 20% nitric acid and 5% hydrofluoric acid



Any increase in throat depth causes an increase in electrical impedance and resistance to welding-current flow, and secondary voltage must be greater to maintain the required welding current

WELDABILITY OF STAINLESS AND LOW-CARBON STEEL

METALLURGICAL STRUCTURE	STRAIGHT CHROMIUM TYPES		CHROMIUM-NICKEL TYPES
	MARTENSITIC	FERRITIC	AUSTENITIC
A.I.S.T. TYPE NUMBERS	403, 410, 414, 416, 420, 440, 406	443, 430, 329, 440	302, 304, 321, 347, 316, 303
CHEMICAL ANALYSIS	Less than 16% Chromium. Less than .40% Carbon. Additions, W, Cu, Ni, Si, Cb, Al, Mo	Greater than 16% Chromium. Less than 0.20% Carbon. Additions, Cu, Ni, Si, Mo, W, N	Greater than 18% Chromium. Greater than 8% Nickel. Less than 0.20% Carbon. Mn can be substituted in part for Ni
MELTING POINT	Less More fluid in molten state.	Less More fluid in molten state.	Less More fluid in molten state.
COEFFICIENT OF EXPANSION	Same or slightly less.	Same or slightly less.	50% greater.
THERMAL CONDUCTION	30% to 40% less.	30% to 40% less.	40% to 50% less.
ELECTRICAL RESISTANCE	300% to 500% greater.	300% to 500% greater.	600% to 1200% greater.
STRENGTH AT ELEVATED TEMPERATURES	Retains tensile properties up to 750F	Tough at temperatures up to 1600F.	High creep strength up to 1200F.
MAGNETIC PROPERTIES	Group is magnetic.	Group is magnetic.	Group is non-magnetic.
HARDENING CHARACTERISTICS	Harden intensely when * cooled in air.	Does not harden by heat* treatment.	Does not harden by heat treatment. Can be hardened by cold working.
SECONDARY SENSITIVE TEMPERATURE RANGES	Not subject to carbide precipitation nor excessive grain growth.	Subject to excessive grain growth, causing brittle structure. Worse when low in C and when high in Si or Al. Action most rapid above 1900F.	Subject to carbide precipitation. The greater the sum of Cr and Ni compared to C, the less rapid the formation of chromium carbides. Action most rapid at 1200F within range 800F to 1500F.
WELDABILITY BY SPOT WELDING	Weld hardens intensely unless carbon is 0.10% or less. Needs special technique to prevent hardening.	Welds fairly well except in those steels sensitive to grain growth.	Welds satisfactorily with a tough ductile weld.

Chromium range, 14 to 18%, may harden, depending on Carbon content.

STAINLESS STEEL SPOT-WELDING VARIABLES

DATA COMMON TO BOTH CLASSES OF SPOT WELDS						WELDING VARIABLES FOR BEST QUALITY CLASS A WELDS						WELDING VARIABLES FOR MEDIUM QUALITY CLASS B WELDS				
NOTE 1,2		NOTE 3,4		NOTE 5	NOTE 6	NOTE 7	NOTE 8 NOTE 9			NOTE 10		NOTE 7	NOTE 8 NOTE 9		NOTE 10	
THICKNESS OF EACH PIECE		ELECTRODE DIA. AND SHAPE		MINIMUM WELD SPACING	MINIMUM CONTRACTING OVERLAP	WELD TIME (SINGLE IMPULSE)	MINIMUM WELD STRENGTH AND ELECTRODE FORCE			APPROXIMATE WELDING CURRENT	DIAMETER OF WELD NUGGET	WELD TIME (SINGLE IMPULSE)	MINIMUM WELD STRENGTH AND ELECTRODE FORCE		APPROXIMATE WELDING CURRENT	DIAMETER OF WELD NUGGET
								ULTIMATE STRENGTH-PSI.						ULTIMATE		
IN.	U.S.S. GAGE	MIN. D, IN.	MAX. d, IN.	IN.	IN.	CYCLES	FORCE LB.	70,000-90,000 LOAD-LB.	90,000-150,000 LOAD-LB.	AMPERES	APPROX. IN.	CYCLES	FORCE LB.	TO 90,000 PSI. LOAD-LB.	AMPERES	APPROX. IN.
.006	38	3/16	3/32	3/16	3/16	2	180	60	70	2000	.045	4	90	54	1650	.040
.008	35	3/16	3/32	3/16	3/16	3	200	100	130	2200	.055	6	100	90	1750	.050
.010	32	3/16	1/8	3/16	3/16	3	230	150	170	2400	.065	6	115	135	1900	.060
.012	30	1/4	1/8	1/4	1/4	3	260	185	210	2600	.076	6	130	166	2000	.070
.014	29	1/4	1/8	1/4	1/4	4	300	240	250	2800	.082	8	150	215	2200	.077
.016	28	1/4	1/8	5/16	1/4	4	330	280	300	3000	.088	8	165	255	2350	.082
.018	26	1/4	1/8	5/16	1/4	4	380	320	360	3200	.093	8	190	290	2500	.089
.021	25	1/4	5/32	5/16	5/16	4	400	370	470	3500	.110	8	200	335	2700	.104
.025	24	3/8	5/32	7/16	3/8	5	520	500	600	4100	.120	10	260	450	3200	.113
.031	22	3/8	3/16	1/2	3/8	5	650	680	800	5000	.135	10	325	615	3900	.128
.034	21	3/8	3/16	9/16	7/16	6	750	800	920	5300	.150	12	375	720	4200	.140
.040	20	3/8	3/16	5/8	7/16	6	900	1000	1270	6000	.160	12	450	900	4700	.150
.044	19	3/8	3/16	11/16	7/16	8	1000	1200	1450	6500	.175	16	500	1080	5100	.160
.050	18	1/2	1/4	3/4	1/2	8	1200	1400	1700	7100	.190	16	600	1310	5500	.180
.056	17	1/2	1/4	7/8	9/16	10	1350	1700	2200	7700	.210	20	675	1560	6000	.200
.062	16	1/2	1/4	1	5/8	10	1500	1950	2400	8400	.220	20	750	1800	6600	.210
.070	15	5/8	1/4	1 1/8	5/8	12	1700	2400	2800	9200	.250	24	850	2200	7200	.240
.078	14	5/8	5/16	1 1/4	11/16	14	1900	2700	3400	10,500	.275	28	950	2480	8200	.265
.094	13	5/8	5/16	1 3/8	3/4	16	2400	3550	4200	12,100	.285	32	1200	3260	9500	.275
.109	12	3/4	3/8	1 1/2	13/16	18	2800	4200	5000	13,600	.290	36	1400	3860	10,700	.280
.125	11	3/4	3/8	2	7/8	20	3300	5000	6000	15,200	.305	40	1650	4600	11,900	.295

NOTES

1—Types of Steel—301, 302, 303, 304, 308, 309, 310, 316, 317, 321, 347, and 349.

2—Use set-up for thinner piece when welding unequal thicknesses. Data should apply with minor changes if maximum ratio between two thicknesses is 3 to 1.

3—Electrode material—RWMA Class 2, Class 3 or Class 11.

4—Electrodes with spherical crown (radius faced) will produce less surface marking than flat faced electrodes.

5—No precautions need be taken for shunting current between welds if the recommended minimum welding spacing is used.

6—Values of overlap based on preventing expulsion of weld metal during welding as well as maintaining weld strength without excessive distortion.

7—Weld time is based on 60 cycles per second frequency.

8—Load is based on tensile-shear specimens made from two coupons in which the overlap is equal to the width of coupon.

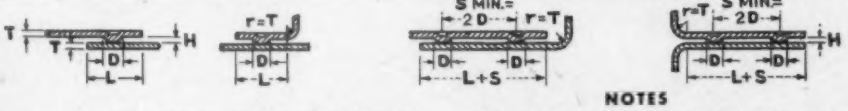
Thickness Range	Width of Coupon	Length of Coupon
0.006-0.029"	5/8"	3"
0.030-0.058"	1"	4"
0.059-0.115"	1 1/2"	5"
0.116-0.190"	2"	6"

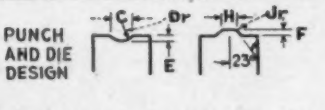
9—The spot welding of stainless steels which are severely cold worked is not recommended at the longer weld times because of excessive loss of cold working while welding.

10—The value of welding current should decrease slightly for steels of higher strength or temper.

STAINLESS STEEL PROJECTION-WELDING VARIABLES

NOTES 1,2,3,4		NOTES 5,6	NOTES 6,7	NOTE 8	SEE "PUNCH AND DIE DESIGN"								NOTE 9			NOTE 10		NOTE 11
THICKNESS OF EACH PIECE "T"		DIA. OF PROJECTION "D"	HEIGHT OF PROJECTION "H"	ELECTRODE FACE DIA.	PT. NO.	±.002 C	Dr	±.001 E	±.001 F	±.001 H	Jr	ELECTRODE FORCE	WELD TIME	HOLD TIME	WELDING CURRENT	MINIMUM SHEAR STRENGTH (UP TO 150,000 PSI. LB.)	DIAMETER OF WELD NUGGET AT INTERFACE IN.	MINIMUM CONTACTING OVERLAP "L" IN.
IN.	U.S.S. GAGE	MIN. IN.	IN.	IN.		IN.	IN.	IN.	IN.	IN.	IN.	LBS.	CYC.	CYC.	APPROX. AMPERES			
.014	29	.055	.015	1/8	1	.055	.033	.015	.015	.035	.005	300	7	15	4500	280	.112	1/8
.021	25	.067	.017	5/32	2	.067	.042	.017	.020	.039	.005	500	10	15	4750	440	.140	5/32
.025	24	.081	.020	5/32	3	.081	.050	.020	.025	.044	.005	600	12	15	5200	600	.140	3/16
.031	22	.094	.022	3/16	4	.094	.062	.022	.030	.050	.005	700	15	15	5750	850	.169	7/32
.034	21	.094	.022	3/16	5	.094	.062	.022	.030	.050	.005	700	17	15	5900	1000	.169	7/32
.044	19	.119	.028	1/4	6	.119	.078	.028	.035	.062	.005	700	20	15	6000	1300	.169	9/32
.050	18	.119	.028	1/4	7	.119	.078	.028	.035	.062	.005	1000	22	15	6500	1700	.225	9/32
.062	16	.156	.035	5/16	8	.156	.105	.035	.043	.081	.005	1200	25	15	7500	2250	.225	3/8
.070	15	.156	.035	5/16	9	.156	.105	.035	.043	.081	.005	1600	27	30	8800	2800	.281	3/8
.078	14	.187	.041	3/8	10	.187	.128	.041	.055	.104	.010	1900	30	30	10000	3200	.281	7/16
.094	13	.218	.048	7/16	11	.218	.148	.048	.065	.115	.010	1900	30	30	10000	4000	.281	1/2
.109	12	.250	.054	1/2	12	.250	.172	.054	.075	.137	1/64	2800	30	45	13000	5000	.338	5/8
.125	11	.281	.060	9/16	13	.281	.193	.060	.085	.154	1/64	2800	30	45	14000	5700	338	11/16





NOTES

1—Types of Steel—309, 310, 316, 317, 321, 347, and 349. Non-hardenable: maximum carbon content 0.15%.

2—Material should be free from scale, paint, grease, oil.

3—Size of projection usually determined by thickness of the thinner piece. Projection should be on thicker piece whenever practical.

4—Data applies to two thicknesses only where ratio of thicknesses is 3 to 1 or less.

5—Tolerance of diameter D is +0.003 in. up to 0.050 in thickness and +0.007 in. up to 0.125 in., inclusive.

6—Projection should be made on piece of higher conductivity when dissimilar steels are used.

7—Tolerance of height H is +0.002 in. in material up to and including 0.050 in. and +0.005 in. up to and including 0.125 in.

8—Electrode material is RWMA Class 3 or Class 12.

9—Weld time based on 60 cycles per second frequency.

10—Load of one projection weld only is based on tensile-shear specimens made from two coupons in which the overlap is equal to the width of coupon.

Thickness Range	Width of Coupon	Length of Coupon
0.006-0.029"	5/8"	3"
0.030-0.058"	1"	4"
0.059-0.115"	1 1/2"	5"
0.116-0.190"	2"	6"

11—Weld should be located in center of overlap.

diameter are better than a few spot-welds of large diameter, as indicated in accompanying tables.

Resistance welders are rated in kilovolt-amperes (KVA) at 50% duty cycle. Thus, an electrical load equal to the KVA rating of the welder can be applied and removed for equal periods of time without overheating the welder if the interval is one-half minute or less. KVA rating does not indicate ability to weld but is a characteristic of the welding machine which depends on geometry of the secondary circuit, manufacture of the machine and desired rate of production.

Welder rating is selected after the welder demand KVA ($F_r \cdot I_r$) and the frequency of spot welds are known. A specific case might be the spot-welding of two sheets of 0.056-in. thick stainless steel, requiring 10,000 amp. welding current and 1/6 sec. welding time. If 30 spot-welds per minute are desired and the job is placed on welders with different throat depths it is apparent that the KVA rating must increase with increase in throat depth. Larger welder throat areas caused by greater throat depths or horn spacings increase electrical impedance and opposition to welding current flow and makes it necessary to raise the secondary voltage to produce the required welding current.

When the welding current flows through the contact and work resistances, heat is generated, and,

Energy for Welding $= I^2Rt +$ *Losses*

where $I =$ *Welding Current*

$R =$ *Effective Resistance*

and $t =$ *Time of Current Flow*

The mechanics of selection of welder rating are based on knowing the welder demand KVA and the duty cycle or *d.c.* The first factor is based on construction of the welder and its resultant electrical characteristics as determined from tests and experience. The second factor is based on the desired speed of operation of the welder. Duty cycle is the ratio of the time of welding current flow in one minute to the total time of one minute.

Expressed mathematically, for 60-cycle-per-sec. frequency,

$$\text{Duty Cycle} = \frac{\text{Cycles of current flow/weld} \times \text{Welds per min.}}{3600}$$

Welder rating at 50% duty cycle is:

KVA rating $=$

$\sqrt{2(d.c.)} \times$ *welder demand KVA*

The most efficient welder should produce the necessary welding current at a minimum KVA demand. A welder with unnecessarily large work clearances increases welder KVA demand, welder rating, power costs and capital investment.

Machines for spot or projection welding stainless steel should have enough rigidity to prevent excessive deflection. Construction of the welder must allow for the increased electrode force necessary for stainless, which is about two to three times that for low-carbon steel. The welder head should have a fast and free movement for dynamic force during welding to compensate for the narrow plastic zone of stainless. This is particularly important on projection welders where the "follow-up" dimension is large.

Only the most modern type of precision control apparatus can guarantee time of welding-current flow and maintain the all-important short weld cycles. For time intervals of less than 6 cycles, a precision synchronous timer should be used. For longer intervals the timer should be accurate but not necessarily synchronous.

When a welding transformer is connected to the power circuit, the current will not immediately assume its steady value. The initial rush of current, as well as the number of cycles intervening before current value becomes steady, depends upon the part of the voltage wave at which the circuit is closed and the residual magnetism in the transformer core.

A precision synchronous timer closes the circuit at a predetermined point on the applied voltage wave and opens the circuit at the instant the current is of zero value, leaving the same amount of residual magnetism present in the transformer core.

Thus, the current value is repeated without uncontrolled transients and the heating value remains the same from weld to weld. Where the weld time is longer, the time of uncontrolled transient current and heating is a smaller part of total heat input, and a synchronous timer is not always necessary.

Synchronous timing also enables each weld to be made with the same even number of half cycles and eliminates any heat variation because of inconsistent timing and failure to reverse the polarity between start and finish of current flow waves.

In the summary of welding variables for chromium-nickel, two types of electrodes, one having a flat face and beveled sides and the other having a dome-type face, are shown. With the flat-faced type, small diameter d should not exceed specified value if the electrode contact area is to be controlled. A smaller value for d will reduce weld strength and cause excessive indentation.

If minimum indentation on one side is required, a dome-shaped electrode is placed against one side and a flat-faced electrode, having a face diameter equal to $2d$, against the side with minimum marking.

Longer weld times and lower electrode forces are used for medium quality Class *B* schedules. These schedules should not be used where slight carbide precipitation or surface discoloration is undesirable, or where a large number of welds are to be made in a small area. Here the heat losses from longer weld times may cause distortion.

It is difficult to make more than one spot-weld at a time unless each electrode has independent current and pressure systems. Such systems increase initial cost, reduce flexibility and on closely spaced welds result in compromise machine construction which reduces weld quality and increases maintenance cost.

Where closely spaced welds are required, it is much more practical to shift from spot to projection welding. In spot-welding, the electrode face must have the proper shape because it concentrates current and force where the weld is to be made. In projection welding, an embossment or projection is raised in one or both pieces to be joined. The projection concentrates current and force and the electrode merely transmits these quantities to the work. The electrode face is made large enough to use a harder electrode material of a lower conductivity.

Projections must be rigid enough to withstand electrode force before the welding current flows. They should have enough mass to raise an area in the flat piece to welding temperature before it collapses. The projections should collapse during welding without expulsion of metal, with minimum space between parts.

The number of projections welded simultaneously should be limited to three unless special conditions warrant the use of more. A plane surface is determined by the three projections, making the welding operation less sensitive to variation in height of projections.

Ed.—Acknowledgment is made by the author for reference to data of the American Welding Society.

TALKING SHOP

WHILE doing some field work for Daffynitions (*Ed. Note:* Corrado was looking out the window), one of the plant men suggested he turn attention to the front office for a change. He said, "A lot of us men don't know what all those high-falutin' titles mean. So why don't you expand our white-collar vocabulary?" So Corrado is bowing to his public (four), and making new enemies in the front office:

PRESIDENT—The guy with no future. He's at the top, and can't go any further.

OFFICE BOY—The guy with a future. He's young enough to take out any girl in the place, and does it, too.

SECRETARY—The boss's boss.

VICE PRESIDENT—This can mean anything from a glorified office boy to a real worker, depending on whether or not he's the boss' relative.

CHAIRMAN OF THE BOARD—The fellow who sits at the head of the table at the Board meeting. His major function is similar to that of the second man on the bob-sled team.

EXECUTIVE VICE PRESIDENT — He never executed anybody, he just tortures them slowly.

SALES MANAGER—The man with more ulcers than the boss.

SALESMAN—The guy who spends half his time running up an expense account, and the other half explaining it.

AUDITOR—A person who doesn't trust anybody, not even his mother.

MARKET RESEARCH MANAGER — The fellow who comes up with sales quotas that keep the Sales Manager in ulcers.

STATISTICIAN—The guy who is only interested in figures, which is not bad when you stop to think of it.

STENOGRAPHER—A blonde, redhead, or brunette, who can type, too.

FILE CLERK—The girl who can put things away so that nobody can find them except herself. Sometimes there are no exceptions.

TREASURER—The man who signs all the checks, but nobody can think of his name.

CONSULTANT — A fellow who'll do anything for a fee.

EFFICIENCY EXPERT—The man with the invisible ax. He thinks that the only way to cut expenses is to lop off heads.

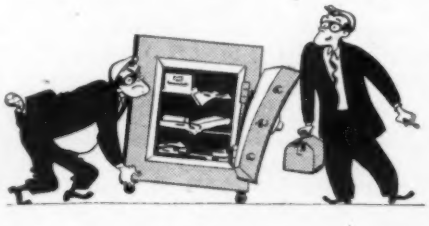
TIME-STUDY MAN—The fellow who walks around the plant with one hand in his pocket, believing that nobody knows he has a stop watch in it.

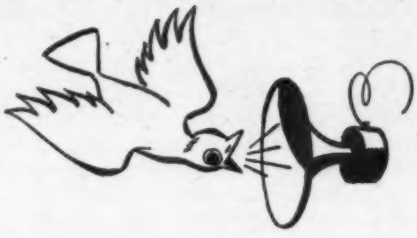
Shaft-bending Dept.

OUT at Westinghouse the engineers have had the sort of job you dream of. They've been designing a new motor and at the same time an entirely new plant to build it in. Frank Rushing, their manager of motor engineering, gets a faraway look in his eye when he thinks of the better than two million square feet of floor space in the plant they took over in Buffalo. Already production in the new plant is underway, though they don't have all those nice new machine tools sorted out yet. One of the things they didn't like about the old production setup was pressing the rotor on the shaft—local name for the operation was the "shaft-bending department." Now they shrink them on.

All Tools Provided

SAFE CRACKERS recently cracked the large safe from the Hess & Barker Machine Shop office. They wheeled it out to the shop, used the company's acetylene torch to burn off the hinges and the company's crowbar to jimmy the door. In return for the use of the tools, they wheeled the safe back to the office before they left with $250.





Tweet Sesame

HOUSING INSTITUTE has announced a supersonic garage-door opener, controlled by a whistle operated from the dashboard of the car. The tweet is picked up by a microphone over the door, magnified by an amplifier, then starts a motor. Successive whistle signals raise, stop, lower and lock the door. Won't work at our house—the birds would drive it crazy.

Stainless Horse

WE WERE among those present at the Waldorf-Astoria showing of the new Alco-Santa Fe diesel locomotive, some 200 ft. of rolling power plant in gleaming stainless and chromium. Reminds us of the yarn about the kid who exclaimed, "Hey, Dad, look at the swell streamlined train!"

To which his father sadly replied, "That's not a train, son—that's just the locomotive." And a substantial compliment to the grades in the Rockies.

Pen Might

CHARLIE WESLOW, whose name you see frequently in our *Practical Idea* pages, is unofficial "Mayor of Kitchell Place" in Newark, N. J., and the proud owner of a 1924 Model T *Ford*. With it, he staged a 1-car parade down Broadway to celebrate the 30th anniversary of the Model T in 1938. Since 1941, it has been on blocks, and when Charley checked it recently, the ring gear was shot. A personal letter from Henry Ford, presented at the Edgewater assembly plant, brought two weeks of frantic contact all over the country, but no ring gear. So Charlie advertised in the local paper—and had a ring gear next day from a neighbor who'd bought two 1924 rear axles for a trailer. The pen is mightier than the Ford.

How to Work MAGNESIUM ALLOYS

BY
ANDERSON ASHBURN
ASSOCIATE EDITOR

MAGNESIUM, infant among the structural metals, lost its swaddling clothes during the war when shortages forced many a manufacturer to turn to it for aid. Because of its light weight and ease of machining, an increasing number of firms which learned about the metal through necessity are now returning to it through choice.

Many of the difficulties encountered in the past were the result of lack of experience on the part of the user. To use magnesium alloys properly requires equally an understanding of their advantages and of their special problems.

Since 1940, when a report on working magnesium alloys was published in AMERICAN MACHINIST, the alloys have been improved and many new methods of fabrication have been developed. This report is a concise survey of present practice, based on the experience of suppliers and users, intended to bring up-to-date the previous report.

Magnesium is probably more widely distributed in nature than any other metal. It can be obtained from ores such as dolomite and magnesite, from underground brines and waste liquors of potash manufacture, and from sea water.

With about ten billion pounds of magnesium in one cubic mile of sea water, there is no danger of dwindling supply. All of the magnesium produced in the world so far could have been taken from about one-tenth of a cubic mile of sea water!

Not only is there an ample supply of raw materials, but there is also an excess of production capacity—plants capable of producing more than 500 million pounds a year having been built in the United States during the war. Use of the metal declined sharply after the war, has been increasing gradually ever since. This year the use of magnesium in the United States will probably be greater than in 1940, and may even exceed the 1941 figure.

Estimates for use of the metal in the next few years vary from 30 to 100 million pounds. Though this is far below the wartime peak, it must be remembered that the bulk of wartime use was in aircraft and incendiary bombs. Applications in the other fields of metalworking are likely to be greater than ever, and widespread knowledge of how to work it is likely to be more necessary than ever.

★ AN American Machinist REPORT TO THE METALWORKING INDUSTRIES ★

Machining

MACHINING CHARACTERISTICS of magnesium alloys are excellent. Usually the maximum speeds of machine tools can be used with heavy cuts and high feed rates. Although the ease of machining is well known and advantage taken of these factors, it has not been possible to make full use of the characteristics because of the limitations imposed by the machines themselves. When magnesium is used in quantities to justify special machine design, even faster and more efficient machining will be practical. Power requirements for magnesium alloys are about one-sixth those for mild steel.

Tool life is generally good. Carbon steels can be used, but better results are obtained with high-speed steels, preferably with surface hardening or chrome plating. Carbide tools give the best results, especially at high speeds, and often result in better operating economy.

An excellent surface finish can be produced, so in most cases grinding is not necessary. Standard machine operations can be performed to tolerances of a few ten-thousandths. There is no tendency of the metal to tear or drag. Chips produced are well broken up when heavy or medium feeds are taken.

Cutting edges must be kept sharp and tool faces polished in order to insure free cutting action and reduce the tendency of particles to adhere to the tip. A central tool-grinding department is advisable where the volume of work will justify it.

Rough grinding may be performed with medium-grain wheels, but finish grinding should be done with fine wheels. Aluminum oxide 100-grit wheels may be used for high-speed steel, but for carbide tools 320-grit silicon carbide or 200- to 300-grit diamond wheels should be used. Honing or lapping improves tool life.

Tools should never be run for their full life before resharpening. The practice of using tools for a definite period, then resharpening, will conserve tool material and insure good cutting edges.

Tools of the same design used for cutting steel or brass may be used; but to take full advantage of the machining characteristics, tool design should be modified. Relief angles should be large and tool design must make allowance for the quantity of chips produced.

In most cases machining can be done dry. Cutting fluids are used primarily to cool the work and reduce the fire hazard, and are required only when taking fine cuts or machining small parts.

Springing of the work may be caused by taking cuts of extreme depth or by using clamping pressures that are too high. Special care must be taken in chucking parts with thin sections.

Aside from too much clamping pressure, distortion is usually the result of overheating the work. Factors causing this are: (1) dull tools, (2) improper tool design, (3) taking cuts that are too fine, (4) dry cutting on thin or small sections, (5) heavy cutting pressure on thin parts.

Distortion rarely is the result of stresses from casting, flanging or extruding. Stresses may result from straightening parts that will lead to distortion. These can be relieved before machining by heating to 500 F. for 2 hr., followed by slow cooling.

Turning and Boring

Machining practice with lathes, making allowance for more careful chucking and slight variations in tool design, is similar to that for brass or steel. The tool must be backed away from the work when not cutting.

Back and side rake angles may vary considerably, are usually 0 to 15° with high-speed tools and 0 to 8° with carbide tools. Relief angles should be large, usually 8 to 12°. Side and end cutting-edge angles can be varied widely as required, but side cutting-edge angles above 40° will cause chatter. Back rake is usually held below 8° on wide forming tools to prevent chatter.

Finishing tools should have a round nose or a flat to insure a smooth finish, but the radii should be kept small to avoid rubbing. Parting tools should have large relief angles, usually at least 6° front and side. Back rake is often 15 to 20°, but may be less.

ALLOYING ELEMENTS

MAGNESIUM, like most pure metals, is soft and has low mechanical strength. When alloyed with other metals it develops properties suited to many uses.

Aluminum, zinc, and manganese are the elements commonly used. Aluminum is usually used in amounts from 3 to 10%, which results in refined grain structure, increased strength and hardness, decreased ductility.

Zinc, usually 1 to 3%, primarily adds to the corrosion resistance of the alloy and also results in improved physcial properties. Manganese in small quantities (0.1 to 0.3%) increases corrosion resistance.

Commercial alloys are designated in this report by the recently adopted ASTM designations. This designation is derived from the nominal composition of the alloying elements. For example, AZ63 is magnesium with 6% aluminum and 3% zinc. One alloy quite different from the others is M1, which contains no aluminum or zinc, but 1.5% manganese. Without high strength, it is relatively cheap, resists corrosion.

Alloys using tin, silver, and copper have been developed in the United States, England and Germany respectively, but are in less-general use. The tin alloy, AT35, is used for forging. Alloys containing cerium have been developed which produce good properties at elevated temperatures. Designating the cerium content by *E*, these alloys are EM42, EM51, EM62, and E10. The EM51 alloy has good forging properties. These alloys are not yet commercially available.

Alloys containing beryllium in quantities of about 0.005% have been found to burn less readily. Zirconium alloys are being developed for high-strength uses.

Impurities, especially copper, nickel, and iron greatly reduce the corrosion resistance of the alloys. Copper is always limited to a maximum of 0.05%. The comparatively recent development of controlled-purity alloys, in which the amount of nickel and iron is limited to 0.005%, has resulted in much better corrosion resistance. These alloys are indicated by an X following the ASTM designation. (Dow designations by suffix —1, AMC by preflex C. Examples: AZ 31X, FS-1, C52S.)

Almost any depth of cut can be taken. Cuts as high as 0.500 in. are being used commercially. In practice the amount of stock to be removed can be taken off in a single roughing cut, leaving 0.003 to 0.004 in. for a finishing cut.

Feeds can be varied from 0.003 to 0.200 in., but heavy feeds do not leave a good finish. Best results are obtained with feeds below 0.025 in. Extremely fine cuts should be avoided as much as possible because they heat the work more than heavy cuts, and the fine chips burn more readily.

Surface speeds as high as 5000 fpm. have been used successfully, but general practice is to use speeds from 150 to 1000 sfpm. on vertical boring mills and 400 to 2500 sfpm. on lathes. Usually the fastest speed available can be used.

Shaping and Planing

The same tool designs as discussed for turning and boring can be used for shaping and planing, varying the shape as necessary. Adequate relief angles and smooth tool surfaces are essential.

The cutting speed used will of necessity be much lower than that used for turning. This can be partially compensated for by using heavier feeds and deeper cuts. The size of cut is limited by the finish desired and the rigidity of the work and clamping fixtures. The possibility of introducing machining stresses is also a factor. The tool must be lifted on the return stroke to avoid marring the surface.

Broaching

Standard broaches can be used, but better results will be obtained with certain alterations in design. A hook or rake angle of 10 to 15° with relief angles of 1 to 3° is advisable. Large chip spaces are needed.

Heavy cuts should be taken, with even the finishing teeth cutting about 0.002 in. If trouble is encountered in maintaining the proper tolerance *increase* the size of the finishing cut. Contrary to practice with other metals, an extremely fine finish can be obtained with a relatively heavy finishing cut. A cutting fluid to keep the teeth free is advisable.

Milling

Surface speeds as high as 9000 fpm. are being used with magnesium alloys. Such speeds indicate the possibilities in taking full advantage of the machining characteristics of magnesium. Such speeds are still considered exceptional, with standard practice calling for speeds of 1000 to 3500 sfpm. and speeds up to 5000 sfpm. frequently encountered.

Standard milling cutters can be used if they have sufficient chip clearance, but it is better if the cutters have no more than half as many teeth as for steel. In general, the fewer teeth the better, and single- or multiple-tooth fly cutters give unusually good results. Inserted-blade face mills with large chip spaces work very well.

Usual standards for cutter design are for rake angles from 5 to 20°, relief angles of 7 to 10° for about 1/16 in., followed by a clearance of 20 to 30°. Behind the clearance the blank is cut away sharply to provide generous chip clearance.

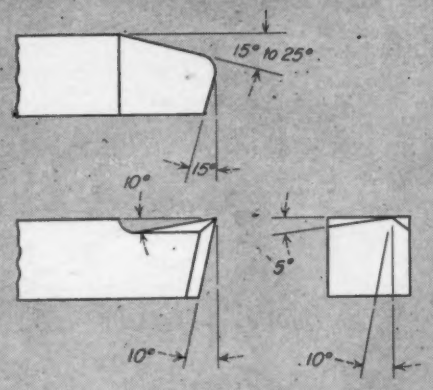
Face mills usually have axial rake angles of 5 to 15°, but are sometimes used with a negative axial rake to throw chips out of the cutter. On end and slab mills helix angles of 10 to 25° are customary, while with helical mills the helix angle should be about 45°.

The depth of cut is largely determined by the amount of material to be removed. Usually a single roughing cut is taken, with at least 0.003 to 0.004 in. for a finish cut. Slower speeds are used with deep cuts.

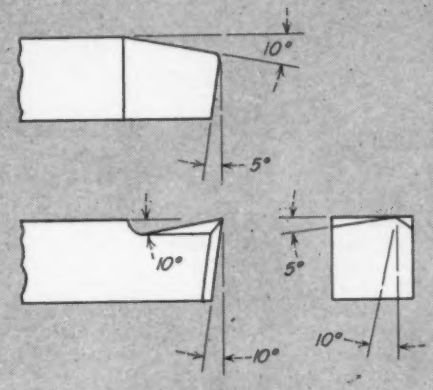
Feeds will vary with the speed and depth of cut, usually in the range from 0.004 to 0.025 in. per tooth. With high speeds this means a table travel of 10 to 30 in. per min.

Milling can usually be done dry,

TYPICAL TURNING TOOLS

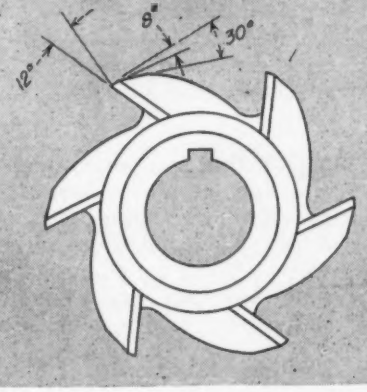


Roughing tool



Finishing tool

TYPICAL MILLING CUTTER

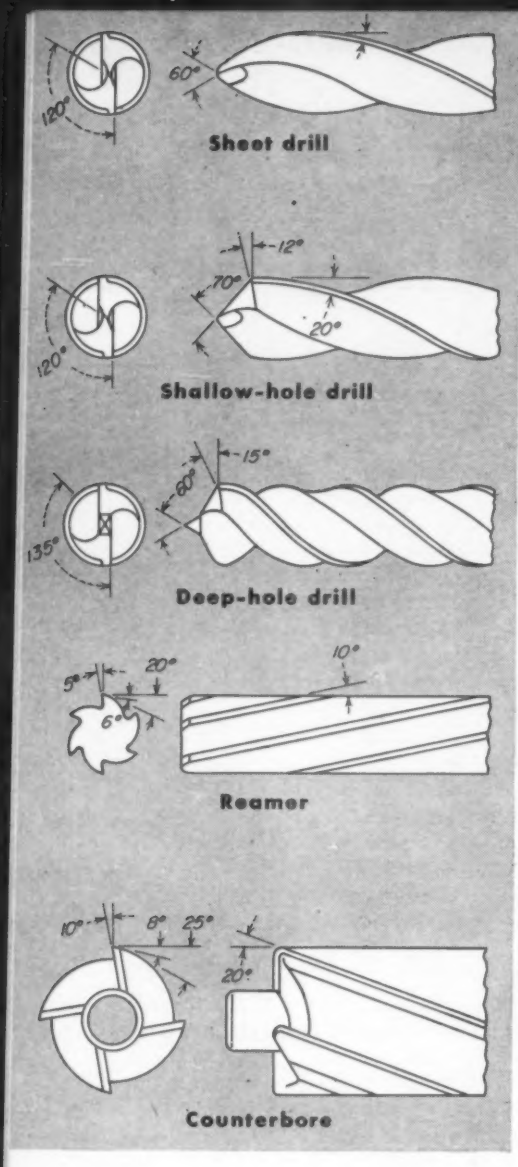


RECOMMENDED MILLING SPEEDS, FEEDS AND CUTS

Speed fpm.	Feed ipm.	Feed in/tooth	Depth of cut in.
		Roughing	
up to 900	10-50	0.005-0.025	up to 0.500
900-1500	10-60	0.005-0.020	up to 0.375
1500-3000	15-75	0.005-0.010	up to 0.200
		Finishing	
up to 1000	10-50	0.005-0.015	up to 0.075
1000-3000	10-70	0.004-0.008	0.005-0.050
3000-5000	10-90	0.003-0.006	0.003-0.030
5000-9000	10-120	0.002-0.005	0.003-0.030

RECOMMENDED TURNING SPEEDS, FEEDS AND CUTS

Surface Speed fpm.	Feed ipm.	Max. Depth of Cut in.
	Roughing	
300-600	0.030-0.100	0.500
600-1000	0.020-0.080	0.400
1000-1500	0.010-0.060	0.300
1500-2000	0.010-0.040	0.200
2000-5000	0.010-0.030	0.150
	Finishing	
300-600	0.005-0.020	0.100
600-1000	0.005-0.020	0.080
1000-1500	0.003-0.015	0.050
1500-2000	0.003-0.015	0.050
2000-5000	0.003-0.015	0.050



but on thin sections or high speeds and light cuts a coolant is used to prevent overheating of the work. A mirrorlike finish can be obtained with a heavy roughing cut at relatively low speed and a fine finish cut at the maximum possible speed.

Drilling

Magnesium sheet can be drilled with a standard 118° point-angle drill. Better results are obtained by modifying the drill to a 60° point angle, which prevents "walking," reduces thrust, and prevents an abrupt change of thrust on breaking through. If the drill is so modified, the chisel-edge angle should be 120 to 135°, the web should be thinned to help center the drill and reduce burrs and give a smooth finish. A 10° helix will keep work from climbing.

Shallow holes up to five times the diameter can be drilled with few difficulties. The point angle may vary from 70° to the standard 118° with chisel-edge angles 120 to 135°. Lip relief should be about 12°. The standard 25° helix can be used, or the helix may vary from 10 to 30°. Flutes should be highly polished to facilitate chip flow. Corners of cutting edges should be rounded.

Deep holes require special drills, but with such drills speed and precision are possible on holes as deep as 25 times the diameter. A high helix, 40 to 45°, should be used. An improved version has a 10° helix at the tip, changing to a 40 to 45° helix for the shank. Flutes should be open and polished for large chip spaces and the web should have a constant thickness so there will be as much chip space at the shank end as at the point end. The standard 118° point angle is the most satisfactory, but a spur or pilot point should be ground at the chisel edge to reduce spiralling. Chisel-edge angles should be 135 to 150° to secure a good surface and minimize spiralling.

Use the maximum speed obtainable when drilling. Speeds of 75 to 400 fpm. are in general use, but speeds up to 2000 fpm. are quite satisfactory and 300 fpm. is often given as the minimum desirable.

Feeds used should be heavier than for other metals. Recommended feeds for several drill sizes are given in the table. Considerable variation from these is possible in drilling sheet, but for deeper holes recommended feeds should be followed.

Reaming

As in most other operations, standard reamers designed for steel can be used, but better results can be obtained by using fewer flutes. For diameters under 1 in., four flutes are advisable; for large sizes six flutes are advisable. The flutes may be straight or have a —10° helix.

Recommended design includes 5 to 8° rake angle, 4 to 7° relief angle, 15 to 20° clearance angle. Use a narrow margin 0.010 to 0.025 in., to avoid springing. In some cases, zero margin is used.

Wide choice is permissible in speeds and feeds, with the maximum speed of the machine and a medium feed usually giving the best results. Take a definite cut to avoid compressing the metal. A cut of 1/32 in. on the diameter is usually enough. Too heavy a cut will jam the flutes with chips.

Counterboring

Counterbores should be ground similar to end mills, and may be high-speed steel or carbide. Margins should be small with clearance large enough to prevent rubbing and to provide good chip space. Corners should be rounded on the cutting edge with a radius of at least 1/16 in.

The helix angle, which will determine the rake of the cutting edges, should be about 20°. Margins should be about 0.015 in., with relief angles 6 to 10° and clearance 15 to 25°.

Tapping

Standard taps can be used in many cases, but for high production or close tolerances special taps are needed. Taps should be high-speed steel with wide straight fllutes. The rake angle should be 10 to 25°, with a heel rake of 3 to 5°. The chamfer shoul dextend over 2 to 3 threads.

Lands should be cylindrical (without radial thread relief) and narrower than usual. This, with the heel rake, provides a cutting action when backing out which prevents jamming of the chips. If the tap cuts oversize decrease the rake angle; undersize increase the rake angle. Use two flutes for holes under ¼ in., three flutes to ¾ in., and four for larger taps.

Dull taps will cut undersize. A cutting fluid is advisable. Tapping speeds from 75 to 200 fpm. give good results. Tapping heads and tapping machines are satisfactory but require careful operation because inadvertantly forcing the tap will keep it from following its own lead and cause errors. More accurate threads can be cut with a lead screw.

Threading

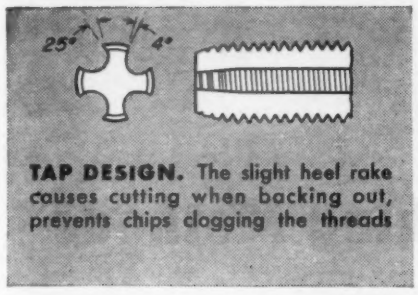
Threading dies should have about the same cutting angle as taps, with narrow lands for adequate chip clearance. Thread chasers should be similar to turning tools, except that larger rake angles should be used. Cutting edges must be kept sharp. Speeds up to 1000 fpm. can be used for thread chasing.

Screw-machine Work

The good machining characteristics of magnesium make it well suited for use in automatic screw machines. Usually the maximum speed of the machine can be used with feeds 50

FEEDS FOR DRILLING MAGNESIUM

Drill Dia. in.	Feed — in. per revolution		
	Sheet	Shallow Holes	Deep Holes
¼	0.005-0.030	0.004-0.030	0.004-0.008
½	0.010-0.030	0.015-0.040	0.012-0.020
1	0.010-0.030	0.020-0.050	0.015-0.030



TAP DESIGN. The slight heel rake causes cutting when backing out, prevents chips clogging the threads

to 75% higher than for brass. The factors affecting the feed used are the tool condition, the finish desired, and the size of the work. Feeds below 0.015 in. will produce long, coiled chips. Heavier feeds produce chips that are well broken up. A cutting oil is usually used to control the thermal expansion.

Tools can be about the same as those for brass. They can be either high-speed steel or carbide.

Standard box tools can be used without change. Chip breakers are not required. Form tools should have 0 to 10° rake. Better chip breakage will result with 0° rake. Relief angles should be at least 8°. A side relief of about 1° may be desirable to minimize rubbing on the work. The ratio of maximum width of cut to diameter of work is approximately 2 for magnesium.

Drills, taps, threading dies, and thread chasers should be similar to those described in earlier paragraphs.

Routing

Routing may be done on any type of router. The bit should be a single- or double-flute type with well polished flutes for good chip removal. Flutes may be straight or up to 15° helix. Somewhat faster cutting is possible with straight flutes, but helical flutes have less tendency to become clogged with chips. Router bits ¼ or 5/16 in. in dia. are used at speeds from 5,000 to 20,000 rpm. Using a coolant will help in preventing load up and give maximum protection from the fire hazard.

Sawing and Filing

Magnesium can be cut readily by band or circular saws, hand or power hacksaws. Blades must be sharp and designed with more chip space than usual. Lubricating with a tallow stick will reduce friction.

Bandsaws usually have 4 or 5 teeth per in., with a tooth set of 0.02 to 0.05 in. Relief angles should be 20 to 30°. Cutting speeds up to 15,000 sfpm. are used. Circular saws should have coarser pitch, with only ½ to 2 teeth per in., but tooth set and relief should be about the same.

Hand hacksaws work well with 10 to 14 teeth per in. Blades are usually 0.02 to 0.03 in. thick and ½ in. wide. Power hacksaw blades will vary with the machine size. One recommendation for a medium-sized unit is a wide blade 1/16 in. thick with 0.5-in. pitch and 0.03-in. tooth set. Pitch will usually vary to provide 2 to 6 teeth per in., tooth set 0.015 to 0.03 in., and relief of 20 to 30°. Use the maximum speed of the machine with a heavy cutting pressure.

Single- or double-cut hand files may be used, but the single cut is usually preferred. Coarse, bastard, second-cut, or smooth may be used. Light cutting pressure must be used with the smooth cut or it will clog. Milled tooth files with curved teeth cut rapidly and leave a good finish.

Rotary files or burs should be single cut, medium-coarse. They are excellent for cleaning up castings. Surface-hardening or chrome-plating will add to tool life. Speeds of 4500 to 7000 rpm. should be used.

Grinding and Polishing

Finish grinding is rarely needed because fine finishes can be produced by machining. Finish grinding requires a 40 to 70 grain-size wheel and a cutting oil in sufficient quantity to quench all sparks and wet all the dust produced.

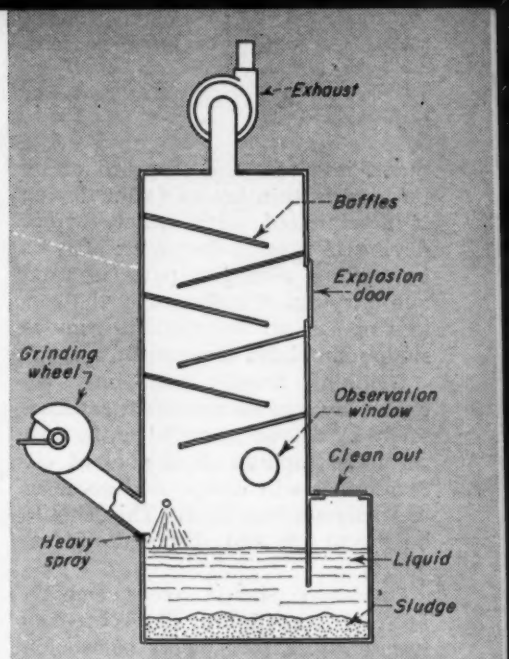
Rough grinding is widely used for removing flash and for foundry cleanup. It is done dry in conjunction with a suitable system for precipitating and collecting the dust. Use a 20 to 40 grain-size wheel with an open structure range of 4 to 8. Silicon-carbide or aluminum-oxide wheels with vitrified or resinoid bonds can be used. Grinding wheels used for magnesium should be marked "For Magnesium Only." Avoid sparks. Watch out for iron inserts, core wires, and skim gates.

Polishing is easily performed and provides a lustrous surface when desired for plating or decorative purposes. Polishing methods are outlined in a table.

The dust produced in grinding and polishing is highly inflammable and in proper proportion with air can explode in the same manner as fine coal or flour dust. Dust should be removed immediately by a suitable collection system. Central dust-collection systems in which the dust passes through long, dry ducts or filter collectors are unsafe.

The best system is one in which the dust is precipitated by a heavy water spray or thin mineral oil to form a sludge with an excess of liquid. The system should be designed so dust cannot accumulate in any location where it will dry out. Systems should receive periodic inspections. A central system can be used if dust is precipitated by sprays at each stand and conveyed in a flowing stream to the settling tank. Power should always be interconnected so grinders cannot be operated unless the collector is turned on.

Sludge should be removed at fre-



DUST COLLECTOR. An individual collection unit recommended for grinding-wheel stands in frequent operation

METHODS OF POLISHING MAGNESIUM ALLOYS

Operation	Type of Wheel	Abrasive	Wheel Dia. in.	Wheel Speed fpm.
Rough Polish[1, 2]	Canvas, sheepskin or felt	60 to 100	6 to 12	3,000 to 5,000
Medium Polish[2]	Built-up cloth	100 to 200	6 to 12	4,000 to 6,000
Dry Fine Polish	Loosely sewed buff	Dry compound	6 to 12	3,500 to 5,000
Buffing	Loosely sewed buff, 74-82 count cloth	Tripoli	10 to 14	6,000 to 8,000
Coloring[3]	Canton flannel buff	Dry lime	12 to 16	8,000 to 12,000

1. Needed only for rough surfaces such as sand castings
2. Grease stick may be used
3. Use minimum pressure for best luster

quent intervals and disposed of by burning in thin layers (after drying if precipitated with water, before drying if precipitated with oil), or by mixing with five parts of sand and burying. A conveyor in the bottom of the settling tank to remove sludge simplifies cleaning.

Grinding wheels used only occasionally can be protected satisfactorily by a hood arranged so the dust particles impinge on a pool of oil. Some dust will escape and settle in the surrounding area. This should be swept up and disposed of frequently.

Operators should wear smooth, fire-retardant clothing that is brushed frequently. Fire showers or woolen blankets to smother flames should be nearby. Smoking must be prohibited in the area. Extinguishing compound should be available at each grinding wheel in plainly labeled, covered containers.

Cutting Fluids

Cutting fluids are used to cool the work and reduce the fire hazard. They have little effect on surface finish or tool life. When thin sections are machined or when high speeds are used, particularly with fine feeds, a cutting fluid is advisable. In general if speeds over 750 fpm. with feeds under 0.010 in., are employed, a cutting fluid should be used.

The most desirable coolant is a low-viscosity, high-flash-point, mineral-oil base fluid. Vegetable or animal oils are not recommended. Water-soluble mixtures should never be used because of the hazard involved in chips wet with water and because chips wet with water cannot be economically reclaimed.

Mineral seal oil or kerosene may be used. Fluids have been developed by manufacturers of cutting oils which perform very satisfactorily.

Sheet Working Methods

MAGNESIUM-ALLOY SHEET can be fabricated in much the same way as other metals, with one important provision. The work must usually be done at elevated temperatures. The crystal structure is such that the alloys work-harden rapidly at room temperatures. Working is usually done from 450 to 650 F.

The disadvantages of this condition are obvious. Heating dies and work is expensive and troublesome and there are problems in lubrication and handling material at these temperatures. Compensations are offered by the fact that in the range used magnesium is more easily formed than other materials. Springback is reduced, resulting in greater dimensional accuracy. The diameter of drawn parts can be controlled by temperature adjustment if dies are not made of magnesium so that slight errors in die size can be corrected. Instances have been reported in which parts were formed with a single draw in magnesium that had required two or more draws in other metals, eliminating annealing and redrawing operations, and resulting in greater economy.

When trial runs are to be made or only a few parts are to be produced, heating can be accomplished with hand torches or by heating in ovens. Temperatures can be checked with hand pyrometers or by temperature-indicating lacquers, crayons, or pellets. Blue carpenters' chalk turns light brown or white, and yellow laundry soap turns dark brown at approximately the right temperature.

For production work, dies are heated by gas or electric heaters, usually with permanent temperature indicating and controlling equipment installed. A standard type of gas burner can be made of ¾- or 1-in. pipe bent to the desired shape and drilled with No. 40 holes on ½-in. centers.

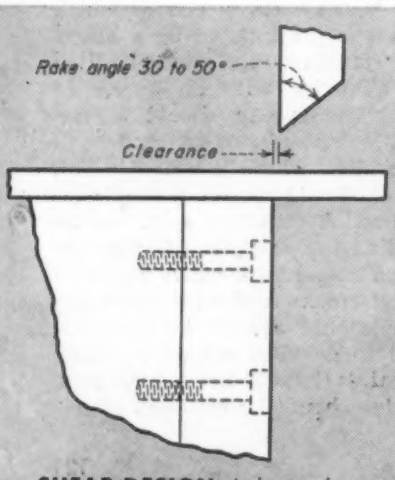
Electric heaters are growing in popularity. Cartridge heaters in holes drilled in the die and strip heaters clamped to the surface, are used.

Stock is usually preheated to avoid delay in heating in the dies. Flat sheet may be heated in ovens; a faster method is to heat by pressing between flat heated plates. Electric strip heaters are usually used to heat the plates. Preheating oven should be as close to the press as possible.

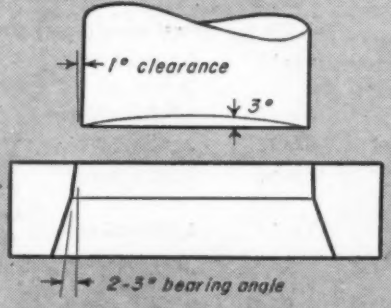
Shearing

Sheet can be sheared in much the same way as with other metals, but a rough, flaky fracture is produced on sheet thicker than about 0.064 in. To minimize this effect, use as small a clearance as possible and a rake angle of 30 to 45° on the upper shear blade. Maximum clearance should be 3 to 5% of the sheet thickness. Sheet less than ⅛ in. thick is usually sheared with a clearance of 0.003 in.

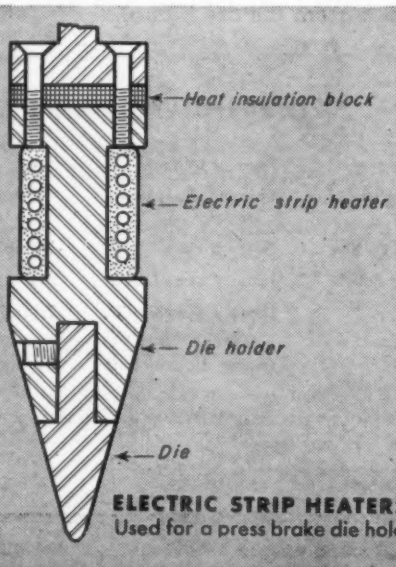
Better results can be obtained by "shaving"—removing 1/32 to 1/16 in. in a second shearing operation. Above ⅛-in. thickness, sawing is preferable if a smooth edge is required. A better edge will result on



SHEAR DESIGN. A sharp rake on the shear and a small clearance help produce smooth edges



BLANKING DIE. When used for punching the shearing angle should be on the punch and the clearance angle on the die



ELECTRIC STRIP HEATERS. Used for a press brake die holder

FORMING CHARACTERISTICS OF SHEET MAGNESIUM ALLOYS

Alloy	Condition	Approximate minimum 90° bend radius — t = sheet thickness, 70 F.	400 F.	600 F.	Maximum % reduction per draw 70 F.	400 F.	600 F.	Best working temperature, F.
AZ31X	annealed	4t	3t	2t	20	30	50	500
	hard rolled	12t	4t	2t				350
AZ51X	annealed	5t	4t	2t	15	25	40	550
	hard rolled	15t	5t	3t				400
M1	annealed	5t	3t	2t	20	30	50	600
	hard rolled	12t	5t	2t				400

sheet over 0.064 in. thick if it is sheared hot. Annealed sheet can be heated to 600 F., but hard-rolled sheet should not be heated above 275 F. for AZ31X or 400 F. for AZ51X or M1. Allowance must be made for expansion in hot shearing.

Blanking and Punching

For blanking and punching operations the punch is usually made of softer material than the die to permit a sheared-in fit.

When sheet is over 0.065 in. thick, the operation is usually done hot. However, one company reports punching M1 cold up to ¼-in. thick with excellent results. Shear angles of 2 to 3° are placed on punch or die, depending on which edge is to have the better surface. A slight rake, about 3°, in the punch also helps.

Blanking can be done by the Guerin process (see below) and has the advantage that forming can be included in the same operation.

Bending

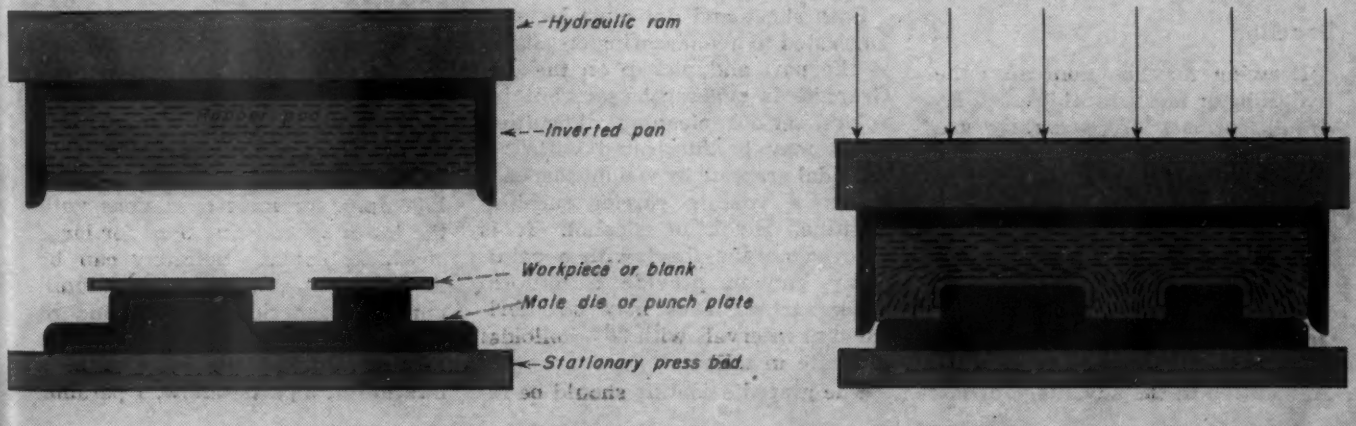
Straight bends with short radius can be made by the Guerin process or by press or leaf brakes. Die and rubber methods are used where bends at right angles complicate brake operation. Folding leaf brakes are rarely used because they tend to concentrate deformation at clamping edge and heating is difficult.

Press brake dies are heated with electric strip heaters. Dies insulated from the press shorten heating time and prevent excessive heating of the press. The bottom die is often rubber in a U-shaped die. It can be insulated by placing insulating material between the press bed and bedrail.

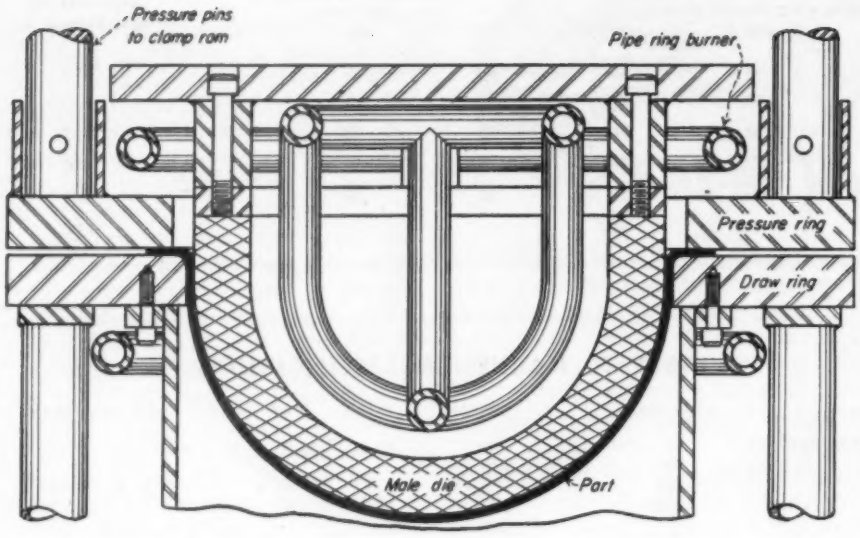
Roll forming has been used to form AZ31X annealed into structural members. It was done cold on equipment designed for aluminum.

INDEX TO MAGNESIUM SPECIFICATIONS

Form	Alloy No.	ASTM	SAE	Joint Army-Navy
Sand Castings				
	A10	B80-44T		
	AZ63	B80-44T	50	AN-QQ-M-56
	AZ92	B80-44T	500	AN-QQ-M-56
	M1	B80-44T		AN-QQ-M-56
Perm. Mold Castings				
	A10		502	
	AZ92		503	
Die Castings				
	AZ90	B94-44T	501	AN-M-16
Extrusions (Bars, Rods, Shapes)				
	AZ31X	B107-44T	52	AN-M-27
	AZ61X	B107-44T	520	AN-M-24
	AZ80X	B107-44T	523	AN-M-25
	M1	B107-44T	522	AN-M-26
Tubing				
	AZ31X		52	AN-T-72
	AZ61X		520	AN-T-71
	M1		522	AN-T-73
Forgings				
	AT35	B91-44T	53	AN-M-23
	AZ31X	B91-44T		
	AZ61X	B91-44T	531	AN-M-20
	AZ80X	B91-44T	532	AN-M-21
	M1		533	
Rolled Sheet & Plate				
	AZ31X	B90-44T	510	AN-M-29
	AZ51X	B90-44T	511	AN-M-28
	M1	B90-44T	51	AN-M-30



GUERIN PROCESS. A heavy rubber pad is used with a single die for shallow forming



RING BURNERS, arranged to heat dies for deep drawing. The burner is placed 5/8 in. from the surface to be heated, but at least 2 in. from the inside of the draw ring

Forming

The most widely used method for forming and shallow drawing is the Guerin process. In this process a rubber pad is used as the female die. The work blank is positioned on the male die which is located on the press platen. The rubber pad, confined in an inverted steel pan, is lowered by the hydraulic-press ram. The pad bends the work to the shape of the male die.

Heating is usually accomplished by heating the lower-press platen. Magnesium is the best material for the dies since it has the same thermal expansion as the work.

For working temperatures of 250 to 350 F. rubber of Shore Durometer hardness of 60 with Shore elasticity of 75 to 80 is the best material. For temperatures up to 450 F. a synthetic rubber should be used.

Experience with this method has indicated that the best results are obtained by using the minimum permissible temperature.

Drawing

Drawing may be done in either hydraulic or mechanical presses. Hydraulic presses are generally used when deep draws are made, with speeds slower than those used for steel. Single-action presses can be used with pneumatic cushions or spring hold-down clamps. Double- or triple-action presses are desirable. Mechanical presses equipped with pneumatic or hydro-pneumatic cushions, have recently come into use. In addition to the advantage of faster production, parts that tend to pucker on the punch have been drawn with less difficulty on mechanical toggle presses at a punch speed of 60 fpm. than at 3 fpm. on hydraulic presses.

Pressure rings and draw rings are usually mild steel. They should be stress-relieved at 1200 F. for 1 hr. before finish-machining to avoid warping. Heat-resistant tool steel will give longer life. Entering radius of the draw ring is usually four to eight times sheet thickness.

The punch can be made of steel, cast iron, aluminum, or magnesium. Magnesium is usually best because of its easy machinability, low weight which facilitates setup, and the fact that no correction need be made for thermal expansion. The punch is often left cold, with dies and stock heated. This results in chilling the metal as soon as it is drawn, increasing the tensile strength in the area where failure is most likely to occur during drawing. A water-cooled punch is sometimes used.

Both sheet and die must be well lubricated to avoid scoring or galling of the part and pickup on the die. Graphite is generally used, but involves serious cleaning difficulties. Sheet may be lubricated with 2% colloidal graphite by weight suspended in a volatile carrier such as naphtha, lactol, or alcohol. It is sprayed on the sheet with a paint-spray gun to provide a uniform black surface. Dies may be lubricated at intervals with 20% colloidal graphite in tallow.

The graphite coating should be removed as soon as possible after drawing by a dip in a chromic-acid bath. Usually ½ to 2 min. in 15 to 20% chromic acid is recommended. If the parts are left too long, pitting will occur. If the graphite is not removed completely, the surface can be rubbed lightly with steel wool to complete the removal. Parts are washed in cold running water, with a hot-water dip to speed drying.

Because of the cleaning difficulties with graphite lubricants, efforts have been made to find other lubricants that can be used at the temperatures involved. For draws at temperatures of 525 F. aluminum forging oil has proved satisfactory. It is applied to the die every 10 to 20 draws, and the blank is not lubricated. Yellow laundry soap can be used, but not above 400 F. Other lubricants that have been used are high-flash-point oil, a mixture of beeswax or paraffin and tallow, and cocoanut butter.

Graphite lubricants should not be used on sheet which has a chrome-pickled surface. If the sheet is to be drawn it should be ordered in the oiled condition. Sheet that has been chrome pickled should have the chrome-pickled surface removed by dipping in a 15% chromic-acid bath.

Blank-holding pressures have varied from the minimum feasible to 700 psi. The pressures most commonly used vary from 50 to 200 psi.

Speed of drawing is usually 2 to 4 fpm. when hydraulic presses are used. If a very deep draw is made with a water-cooled punch, a speed of 1 fpm. should be used to allow time for cooling. With mechanical presses higher speeds are used, 180 fpm. having been reported.

The temperature range used for annealed sheet is 400-500 F. for AZ31X, 550-650 F. for AZ51X, and 550-650 F. for M1. For hard-rolled sheet, AZ31X has a maximum permissible temperature of 300 F. for 25 min.; AZ51X and M1 have a hard-rolled temp. limit of 400 F.

Spinning

Moderate spinning is possible at room temperature, but if much deformation is required heat must be applied during spinning. This can be done with a gas torch or ring burner. Speeds used are 1700 to 1900 fpm. for most operations with the lower speed being used for large or thick blanks. Spinning can be done against a wood or cast aluminum or magnesium block. Standard spinning tools are used. Work is lubricated with laundry soap or a mixture of 2 parts tallow, 1 paraffin.

TYPICAL CHARACTERISTICS OF MAGNESIUM ALLOYS

	ALLOY NO.			NOMINAL COMPOSITION (Mg = Remainder)			HEAT TREATMENT†	SPECIFIC GRAVITY (75 F.)	WEIGHT lb./cu. in.	MELTING POINT °F.	TENSION						COMPRESSION M psi.		SHEAR M psi.	BRINELL	ROCKWELL E	FATIGUE M psi.	IMPACT Izod ft./lb.	RESISTANCE TO SALT WATER A=best	RELATIVE COST A=lowest	COLOR CODE AS=Aluminum Stripe
											Ultimate Strength M psi.		Yield Strength M psi.		% Elong in 2 in.										
	ASTM	DOW	AMC	Al	Zn	Mn					Typ	Min.	Typ.	Min.	Typ.	Min.	Ult. Str.	Yield Str.								
CASTINGS	A10	G	240	10.0	..	0.1	AC	1.81	0.066	1100	22	18	13	10	2	1	48	13	17	54	65	10	2	D	A	Purple
				10.0	..	0.1	HT	1.81	0.066	1100	33	29	12	10	8	5	50	12	19	52	62	12	4	D	B	Purple
				10.0	..	0.1	HTA	1.81	0.066	1100	34	29	19	17	2	..	54	19	21	69	80	10	2	D	C	Purple
	AZ63	H	265	6.0	3.0	0.2	AC	1.83	0.066	1135	29	24	14	10	6	4	45	14	18	50	59	11	3	C	A	Green
				6.0	3.0	0.2	ACS	1.83	0.066	1135	29	24	14	10	5	2	..	..	..	..	..	11	..	C	B	Green
				6.0	3.0	0.2	HT	1.83	0.066	1135	40	34	14	10	12	7	46	14	19	55	66	14	5	C	B	Green
				6.0	3.0	0.2	HTA	1.83	0.066	1135	40	34	19	16	5	3	50	19	20	73	83	13	2	C	C	Green
				6.0	3.0	0.2	HTS	1.83	0.066	1135	40	34	17	13	7	4	..	..	..	59	71	13	..	C	C	Green
	AZ92	C	260	9.0	2.0	0.1	AC	1.82	0.066	1110	24	20	14	10	2	1	55	16	18	65	77	11	1	C	A	Orange
				9.0	2.0	0.1	ACS	1.82	0.066	1110	24	20	14	11	2	..	..	..	..	..	..	11	..	C	B	Orange
				9.0	2.0	0.1	HT	1.82	0.066	1110	40	34	16	10	10	6	60	16	20	63	75	14	4	C	B	Orange
				9.0	2.0	0.1	HTA	1.82	0.066	1110	40	34	23	18	2	1	70	23	21	84	90	13	1	C	C	Orange
				9.0	2.0	0.1	HTS	1.82	0.066	1110	40	34	20	16	3	1	..	..	..	75	83	13	..	C	C	Orange
	M1	M	403	..	..	1.5	AC	1.76	0.064	1200	14	12	4.5	..	5	3	27	4.5	11	33	3	..	9	B	B	Yellow
	AZ90	R	263	9.0	0.7	0.2	....	1.81	0.063	1120	33	..	22	..	3	..	58	22	20	60	72	14	2	A	B	Blue
BARS	AZ31X	FS-1	C52S	3.0	1.0	0.3	....	1.77	0.064	1160	40	35	30	22	15	10	60	17	19	49	57	14	..	A	B	Red-AS
	AZ61X	J-1	C57S	6.5	1.0	0.2	....	1.80	0.065	1145	45	40	32	26	15	11	..	20	..	58	70	18	..	A	C	Gray-AS
	AZ80X	O-1	C58S	8.5	0.5	0.2	....	1.80	0.065	1130	49	43	33	25	11	9	..	22	..	55	77	19	..	A	D	White-AS
	M1	M	3S	..	..	1.5	....	1.76	0.064	1200	38	30	26	20	10	3	..	14	..	42	41	9	..	B	A	Yellow
SHAPES	AZ31X	FS-1	C52S	3.0	1.0	0.3	....	1.77	0.064	1160	38	33	26	20	14	8	..	15	..	50	59	..	..	A	B	Red-AS
	AZ61X	J-1	C57S	6.5	1.0	0.2	....	1.80	0.065	1145	44	40	28	22	16	9	..	19	..	64	76	..	..	A	C	Gray-AS
	AZ80X	O-1	C58S	8.5	0.5	0.2	....	1.80	0.065	1130	46	41	29	25	9	6	..	22	..	67	78	..	..	A	D	White-AS
	M1	M	3S	..	..	1.5	....	1.76	0.064	1200	34	29	20	17	9	3	..	11	..	46	50	..	..	B	A	Yellow
TUBING	AZ31X	FS-1	C52S	3.0	1.0	0.3	....	1.77	0.064	1160	36	32	21	16	16	8	..	15	..	46	51	..	..	A	B	Red-AS
	AZ61X	J-1	C57S	6.5	1.0	0.2	....	1.80	0.065	1145	40	36	21	16	14	7	..	15	..	50	60	..	..	A	C	Gray-AS
	M1	M	3S	..	..	1.5	....	1.76	0.064	1200	33	28	21	..	9	3	..	10	..	42	41	..	..	B	A	Yellow
FORGING	AT35	D	65S	3.5	*	0.5	....	1.87	0.067	....	40	36	28	22	12	7	..	21	16	52	..	10.5	..	C	B	Tan
	AZ61X	J-1	C57S	6.5	1.0	0.2	....	1.80	0.065	1145	43	38	26	22	12	6	..	17	21	55	66	16	..	A	B	Gray-AS
	AZ80X	O-1	C58S	8.5	0.5	0.2	....	1.80	0.065	1130	46	42	31	26	8	5	..	25	22	69	80	18	..	A	C	White-AS
		O-1a	C58S-O	8.5	0.5	0.2	a	1.80	0.065	1130	50	42	34	28	6	2	..	28	..	72	82	16	..	A	D	White-AS
		O-1	C58S	8.5	0.5	0.2	HTA	1.80	0.065	1130	50	42	34	28	5	2	..	27	..	72	82	16	..	A	E	White-AS
	M1	M	3S	..	..	1.5	....	1.76	0.064	1200	36	30	23	18	7	5	..	..	..	47	54	..	..	B	A	Yellow
SHEET	AZ31X	FS-1a	C52S-O	3.0	1.0	0.3	a	1.77	0.064	1160	37	32	22	..	21	12	..	16	21	56	67	12	..	B	B	Red-AS
		FS-1h	C52S-H	3.0	1.0	0.3	h	1.77	0.064	1160	43	38	33	26	11	4	..	26	23	73	83	14	..	B	B	Red-AS
	AZ51X	JS-1a	C54S-O	5.0	1.0	0.2	a	1.79	0.065	1150	40	..	23	..	18	..	..	15	20	59	71	14	..	A	D	Brown-AS
		JS-1h	C54S-H	5.0	1.0	0.2	h	1.79	0.065	1150	47	..	34	..	10	..	..	30	21	72	82	16.5	..	A	D	Brown-AS
	M1	Ma	3S-O	..	..	1.5	a	1.76	0.064	1200	33	28	15	..	17	12	..	12	17	48	55	9	..	C	A	Yellow
		Mh	3S-H	..	..	1.5	h	1.76	0.064	1200	37	32	29	22	8	4	..	20	17	56	67	10	..	C	A	Yellow

Modulus of Elasticity—6,500,000 psi.
Coefficient of Thermal Expansion—0.000016 per °F. (65-750° F.)
*Notes: *tin 5.0% †Heat-treatment: AC=as cast HT=solution heat-treated HTA=heat-treated and aged S (ACS and HTS)=stabilized a=annealed h=hard rolled*

Casting and Forging

MAGNESIUM ALLOYS possess good casting characteristics, and the metal is probably most used in this form. Properties compare favorably with those of cast aluminum. A shrinkage factor of 11/64 in. per ft. can be used for castings with unrestrained shrinkage, ⅛ in. for larger castings. One firm reports it simpler to use 5/32 in. for all sizes.

Inserts can be cast in sand castings, with cadmium-plated steel inserts preferred. The minimum section thickness is usually 5/32 in., but under favorable gating conditions ⅛-in. walls can be used.

The usual molding and core-making equipment is employed. If green or dry sand is used, an inhibitor is added. Synthetic sands are usual today.

Patterns designed for aluminum can usually be used, but often certain sections should be increased and radii increased if the casting is to be stressed. Chills are widely used on heavy sections in both cores and molds to obtain uniform solidification between heavy and light sections. Bottom gating is usually used, with more and larger gates and risers than with other metals. Gates are usually slightly thicker than wall thickness of the casting, with gate width about three times gate thickness, and length slightly larger than width. Gates are spaced at twice the width. Runners should have a cross-section equal to the total cross-section of the gates, with sprues half to a quarter the size of the runner. The sprue should be easily choked.

Permanent-mold castings can be used when the quantity justifies the additional expense of the mold. This will be determined largely by the complexity of the part to be cast. A compromise, known as semi-permanent-mold casting, is sometimes made by using a metal mold with sand coring where the coring is complex or the quantities limited. Dies are usually cast iron or Meehanite, but low-alloy die steel is used.

For both types of casting, AZ92 is the common alloy. In sand castings, AZ63 is used where toughness is a factor, though pressure tightness is not as good as with AZ92. For permanent-mold castings, A10 is sometimes used because of its better casting characteristics.

The alloy is normally melted in large tilting-type cast or welded steel pots of about 2000-lb. capacity at 1300 to 1350 F. After being melted with suitable fluxes, it is transferred to smaller pots and a refining flux added. After dross is stirred and removed, the metal is superheated to between 1600 and 1700 F., which refines the grain and results in improved properties. The molten metal is then allowed to cool to pouring temperature and the flux skimmed off. A sulphur-boric acid dusting flux during pouring prevents burning.

Die castings are readily made with magnesium, AZ90 being the common alloy. A newer alloy for die casting is Eclipsaloy No. 130 which is designed for impact resistance and high corrosion resistance. It has a high manganese content (0.5 to 1.5%) and a low aluminum content (1.0 to 1.5%). It can be heat-treated. The cold-chamber process is used, with die-casting machines having injection pressures of 5,000 to 15,000 psi., although pressures may be as high as 50,000 psi. Die locking-pressures are 400 to 600 tons.

Dies are made of a good grade of die steel for quantity production. Section thicknesses should be between 1/16 and 3/16 in. when possible. The minimum practical is about 0.050 in. and the maximum about 0.500 in. The design should be as simple as possible with the same general requirements as for other die-casting metals.

As the ladle will enter the pot frequently to remove the shot for the machine, the refining flux should settle to the bottom. Because this flux gives no surface protection, a sulphur dome is needed over the pot. Protection is provided by an atmosphere of SO_2 generated by burning sulphur in a hollow dome which serves as a cover. Because of the undesirability of the sulphur fumes, a recent improvement is a small sulphur dome large enough to introduce the ladle and remove the shot. The remainder of the pot is covered with the customary flux.

Pouring temperature is 1175 to 1250 F. Die temperatures run from 250 to 600 F., with 400 F. as the average. With high production, it may be necessary to water-cool the die to limit the temperature.

The injection plunger of the machine is usually lubricated. A graphite-type grease similar to those for cold-chamber die casting of other metals is employed. Lubricant should be as little as possible.

At present the cost of magnesium die castings is approximately the same as for other common metals, despite the slower production with the cold-chamber process. Possibilities for developing a method for direct injection are promising and, if realized, will make for more efficient die casting at higher rates.

Extruding

BARS, rods, tubing, and structural shapes are readily formed by extruding magnesium alloys. The alloys used are AZ31X, AZ61X, AZ80X, and M1. Practically any shape for which dies can be formed can be extruded.

Extrusion dies are relatively inexpensive and small quantities will often justify the die expense.

Forging

Hydraulic forging presses are usual, although under certain conditions forging can be accomplished in mechanical presses or drop hammers. Good results have been obtained by blocking in a hydraulic press and finish-forging with a drop hammer. A 30,000-ton hydraulic press was installed in Germany during the war, but considerable difficulty was encountered with distortion. The largest press in the United States is an 18,000-ton press. Distortion is said to be only 0.020 in. with the full 18,000 tons applied.

Common alloys are AZ61X and AZ80X. To a lesser extent AT35, AZ31X and M1 are used. The last three are more adaptable to hammer-forging than the first two, which have a high aluminum content. AZ80X can be heat-treated. AZ61X has better formability and weld-

ability. When strength is not so important, M1 is used.

Dies made for aluminum can frequently forge magnesium alloys also. However, if draft angles are too large, difficulty may be encountered. Draft angles of 1 to 3° for blocking and 3 to 5° for finishing are desirable. Dies should be made of a good-quality forging steel and include provision for uniform and reproducible heating. Forging is difficult with thin sections, and much larger presses are required. It is advisable to keep sections fairly heavy and radii large.

Forging can be done in the range from 550 to 750 F., but best results are obtained between 700 and 725 F. The cerium-bearing alloy EM51 is forged at 850 F. If reheating cannot be avoided it should be limited to 600 to 650 F. To prevent rapid cooling of the work, dies are heated: blocker dies to about 600 F., finishing dies to about 400 F. This may vary from 300 to 600 F., depending on size of work. Above 650 F., the work has a tendency to stick. Some lubrication will be required in most cases. Colloidal graphite in a solvent can be sprayed on small workpieces. For large work, flake graphite in a lead-base oil is generally used. Lubricant should be held to the minimum. The high-temperature, high-pressure oils developed during the war are being considered by some firms as a replacement for graphite lubricant.

Trimming is done best at about 350 to 450 F. If too hot, the trimming will cut into the forging and cause other difficulties; if too cold, a rough, flaky edge is produced. Higher trim temperatures can be used immediately after forging than if the work is reheated.

Quenching in water immediately after forging (if the temperature is still high) prevents recrystallization and grain growth, prevents aging during cooling, makes subsequent aging easier.

When forging, all operations should be considered part of the heat-treatment. Such factors as die temperature will have an influence on the work. One firm reports that if handled properly during forging, it is almost never necessary to solution heat-treat the work.

Cleaning is a problem when graphite lubricant has been used. Sand blasting is usually the best method. No. 120 Alundum grit with 90 to 100 psi. air pressure gives good results. One recommendation is to follow this with a 5- to 10-sec. dip in 8% nitric acid and 2% sulphuric acid. This should be followed by a rinse, a 10 to 20% caustic-solution dip at 180 F. for 5 min., followed by chemical treatment.

Heat-Treatment

The heat-treatments to which magnesium alloys are subject include annealing, quenching, solution heat-treatment, aging, and stabilizing.

Sheet and plate are annealed at the rolling mill. Annealing gives a lower yield strength but greater ductility than is obtained in hard-rolled sheet. It is common when the sheet is to be formed.

The solution heat-treatment is given to put as much of the alloying ingredients as possible into solid solution. It results in a high tensile strength and the maximum ductility. In typical treatments, the temperature is raised from 500 F. to the soaking temperature in about two hours. A10 is soaked at 780 F. for 18 hours, AZ63 is soaked at 730 F. for 10 hours, and AZ92 at 770 F. for 18 hr.

Research has been conducted with quenching following the solution heat-treatment. It has been found that if the work is removed from the furnace and allowed to cool slightly in air, then quenched in water at 180 to 200 F., about 20% increase in mechanical properties is obtained.

Aging is applied to castings following heat-treatment where maximum hardness and yield strength are desired. Forgings made of AZ80X may be aged directly after forging or following heat-treatment. Typical aging consists of holding at 350 to 425 F. for 8 to 16 hr. With the higher temperatures less time is required and elongation is higher, but some yield strength is sacrificed.

Stabilizing is a treatment given castings and may be applied to the metal as cast or following heat-treatment. When applied to as cast work it provides higher creep strength and less growth at elevated temperatures; after heat-treatment it also gives some increase in yield strength. Stabilizing is accomplished by holding the castings (either as cast or after solution heat-treatment) at 450 to 550 F. for 2 to 6 hr.

Die castings made of Eclipsaloy No. 130 are heat-treated by soaking for 5 hr. at 475 F., and cooling in air.

FIRE PREVENTION

CONSIDERABLE MISAPPREHENSION exists about the nature and extent of the fire hazard with magnesium, not alleviated by widespread use of magnesium in incendiary bombs. Even in incendiary bombs, however, the magnesium is difficult to ignite; thermite, which happens to be made of aluminum and iron oxide, must do the igniting.

Magnesium will not burn until it has reached its melting point. Because of the high thermal conductivity, large sections of magnesium will not burn. Magnesium dust and fine chips can be easliy ignited, however, and precautions are essential.

The key to safe handling is good housekeeping. If dust and chips are allowed to accumulate around machines, on clothing, window ledges, or in other spots, there is greater chance for a fire to start and greater chance for it to get out of control. Dust and chips must be removed frequently, put in covered metal containers.

When machining, tools must be kept sharp and fine cuts avoided as much as possible. With speeds above 700 fpm. or fine feeds, a coolant is advisable.

A supply of extinguishing powder should be kept near each machine. Suitable extinguishers are G-1 powder; powdered soapstone; clean, dry, unrusted cast-iron chips; and graphite powder.

If a magnesium fire starts, the extinguisher is sprinkled over the burning mass to form a layer about ½ in. deep. Material is added at any point where the fire seems likely to break through. If the fire is on a combustible surface, it should be covered with extinguisher and shoveled into an iron container.

Water or any standard liquid or foam extinguisher causes the magnesium to burn more rapidly and may cause small explosions. A series of tests recently conducted by an insurance laboratory indicates that with larger fires the use of standard automatic sprinkler systems, though intensifying the fire at the point of origin, reduce the danger of spreading. In tests, the sprinklers prevented spread of the fire to nearby magnesium prevented structural damage to the building.

The greatest danger in handling magnesium occurs during grinding and polishing. Precautions to be observed and methods of dust collection are discussed under grinding.

Joining Methods

RIVETING is the most widely used method of joining magnesium alloys. Aluminum-alloy 56S rivets are most suitable. 56S-0 is used for dimpled sheet and 56S-¼H for all other applications. The rivets are anodized for better paint adhesion. Aluminum alloy 2S or 3S rivets are satisfactory for lightly stressed parts.

Rivet sizes will vary widely to meet individual requirements. The general rule for 56S-¼H rivets is a diameter three times the sheet thickness. The minimum diameter advisable is equal to the thickness of the thickest sheet used. A large number of small rivets is preferred to a few large ones.

Rivet centers should be located at least 1½ diameters from the nearest edge of sheet, 2½ diameters on die castings, and at least 4 diameters apart. Most of the common head types can be used.

Holes may be drilled, or punched and reamed. Punching should not be used on sheet thicker than 0.040 in. Drilling is better for all thicknesses, especially for stressed parts. If parts are drilled together they should be separated and cleaned. When this is not possible clean chips from between the sheet with compressed air or a thin tool. If parts are drilled separately, it is a good idea to drill slightly undersize and ream in final assembly. Clearance between hole and rivet should be as small as possible.

For flush riveting, dimpling is usually used on sheet thinner than 0.050 in. Dimpling is done hot with electrically heated dies which heat the sheet on contact, or by preheating sheet and dies with a torch or in an oven. Holes are drilled or punched about 15% undersize prior to dimpling. After dimpling, they are drilled or reamed to proper size and the holes burred.

Rivets can be driven with rivet squeezers or pneumatic hammers designed for aluminum. There is little difference in the result but greater care must be used with hammers to avoid damaging the hole or overdriving.

To prevent corrosion, rivets other than 56S, 2S and 3S should be set in wet zinc-chromate primer. If steel, copper, or brass rivets must be used, they should be chromium-plated.

Aluminum rivets up to 5/16-in. dia. are driven cold. Larger rivets should be driven hot at a temperature of 630 to 670 F.

Parts to be riveted should have chrome-pickled surfaces and the faying surfaces are given two coats of zinc-chromate primer. The completed assembly should be painted. If magnesium is joined to other metals or wood, the primer should be supplemented with a heavy sealing or caulking compound.

Arc Welding

An outstanding development in methods of joining magnesium alloys is the "Heliarc" method of arc welding. It is now universal for arc welding, and frees the operation from the danger of flux inclusions which may cause corrosion. In the Heliarc method, an atmosphere of helium or argon surrounds the arc and prevents oxidation. Flux is not required.

The choice between helium and argon is the subject of sharp dispute, with each gas having its ardent supporters. Argon is a heavier gas than helium (ten times as heavy), but is more expensive. About three times as much helium must be used, but a closer arc length is required with argon and the welder must be somewhat more skilled. The choice will be largely governed by the cost and availability of the gases.

When pressure in the helium or argon tank drops below 50-100 psi., the gas may contain excessive moisture. It is advisable to discontinue the tank unless the gas is dried by passing through an agent such as magnesium perchlorate. Gas of high purity is necessary.

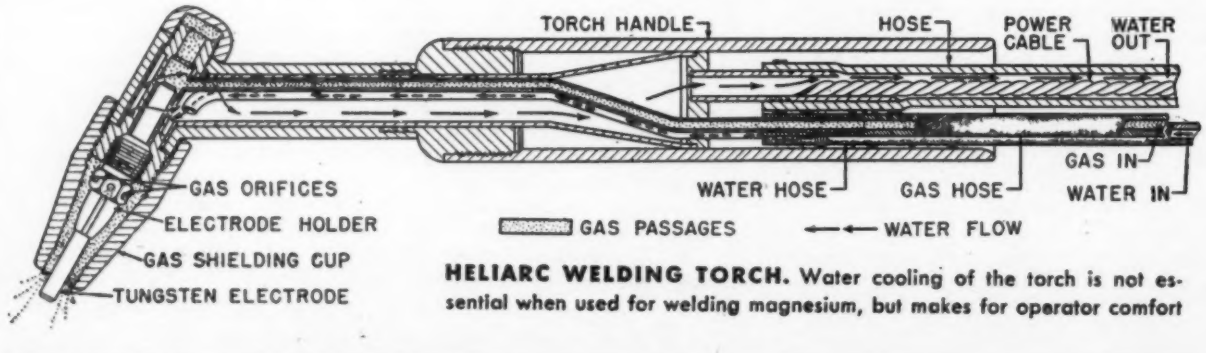
The torch used has a hollow head through which the inert gas passes to the arc. The tungsten electrode is suspended in the center of the hollow head and extends for a distance of 0.250 to 0.375 in. With low currents, a sharp point on the electrode is advisable. Gas is fed at low pressure with a valve normally in the torch handle. Electrodes range from 3/32- to ½-in. dia.

A direct-current, or rectified alternating-current, generator of 100- to 200-amp. capacity is generally used. A stable-arc type machine with a continuous ampere regulator and reversed polarity (electrode positive, work negative) is used.

All magnesium alloys can be arc-welded. However, with wrought alloys AZ31X, with castings AZ63 and AZ92, and with forgings AZ80X, require the most skill. A filler rod of the same material as that being welded is used except with AZ31X, when a filler rod of AZ61X will reduce the danger of cracking.

Cleaning of the surfaces is important. Oil and grease are removed with a solvent. An abrasive cloth or steel wool will remove any chemical finish, oxide, and solvent films. Wire-brushing is not sufficient for chrome-pickled surfaces. Abutting edges should be sanded, milled, or filed. Filler rod and sheet surfaces should be cleaned with steel wool just before welding.

Sheet more than 0.125-in. thick should have the edges beveled to



HELIARC WELDING TORCH. Water cooling of the torch is not essential when used for welding magnesium, but makes for operator comfort

form a 90 to 120° V. Leave a root face of about 1/16 in. Material ¼ in. and over can have a double V.

Backing plates and holddowns are desirable for butt welds. Backing plates should have a groove under the weld. Hold downs should be as wide as possible.

Jigs are desirable for production welding. The entire operation is normally completed in the jig. Fit-up should be accurate as gaps make it difficult to shield the weld. If jigs are not used, the joint is tacked.

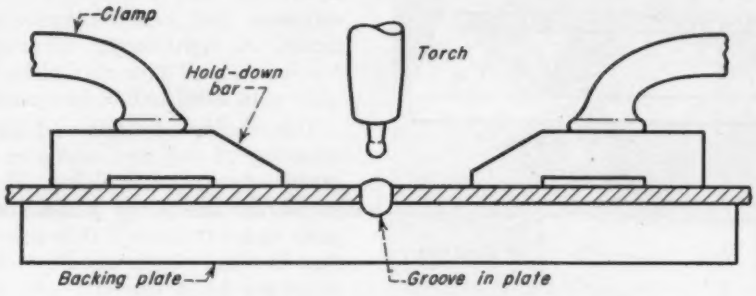
The gas valve must be opened before the arc is struck with a light brushing action. The electrode is held as close as possible to concentrate the arc and keep the bead to minimum width. When metal becomes molten, the filler rod is fed into the arc. The rod must not be pushed into the puddle. The rod should be held at an angle of not more than 30° to the work, the rod and torch should be at an angle of about 90° to each other and the torch moved at a constant speed. If it is necessary to stop, a ½-in. overlap is necessary when work is resumed. Gas flow is continued for a few seconds after extinguishing the arc.

If difficulty is encountered with cracking, scrap pieces of plate can be butted against the ends of the joint. The weld is started in one plate, continued across the joint, and stopped in the second plate. An alternative method is to start in the middle and weld to each end. Preheating plate and jig to 200 to 400° F is also common.

Multiple passes should be made when material is more than ⅜-in. thick, wire-brushing between beads. If a double V is used, a single pass on each side can be taken up to ⅜-in. thickness. Above this, multiple passes should be taken on each side. When welding from both sides, the back of the first bead must be chipped or routed before the second is made. Beads should be flat or concave, because convexity is likely to cause incomplete fusion and inclusions between passes.

Residual stresses as high as 15,000 psi. may exist after welding. These should be relieved by heating. Jigs during heating prevent warping. If of steel, they must be designed to allow for the greater expansion rate of magnesium.

After stress-relieving, the weld area is wire-brushed to remove the oxide before chemical treatment.



BACKING PLATE. A grooved backing plate with hold downs prevents metal "drop down" and warpage

Gas Welding

Gas welding is usually preferred to arc-welding for sheet less than 0.1 in. thick which is not highly stressed. It has the advantage that fit-up is less critical, with gaps up to six times sheet thickness (⅜ in. maximum) possible. As a result, much simpler jigging can be used than with arc-welding.

Gas welds are limited, however, to butt or corner joints in which there is no danger of flux entrapment. Welds must be made in a single pass, as flux entrapment is likely if multiple passes are attempted. The flux is highly corrosive and if left in contact with magnesium will lead to trouble. The flux is necessary to prevent oxidation, but involves serious cleaning problems.

Oxycarbohydrogen, oxyacetylene, or oxyhydrogen can be used. Oxy-

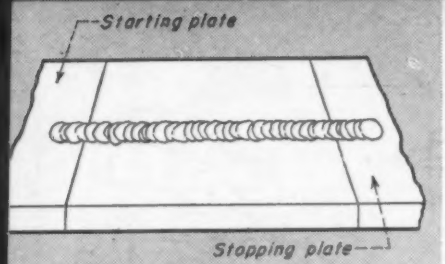
SELECTION AND REGULATION OF GAS-WELDING EQUIPMENT

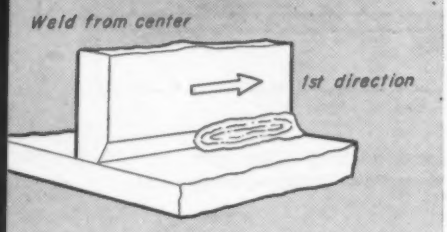
OXY-ACETYLENE

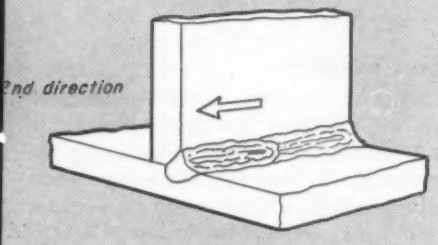
Metal Thickness Inches	Welding Rod Diameter Inches	Orifice Diameter Inches	Drill Number	Oxygen Pressure Lb. per Square Inch	Acetylene Pressure Lb. per Square Inch
0.020	1/16 – 3/32	0.035	65	1 to 4	1 to 3
0.032	1/16 – 3/32	0.035	65	3 to 5	1 to 3
0.040	3/32 – 1/8	0.035	65	3 to 5	1 to 3
0.051	3/32 – 1/8	0.035	65	3 to 5	1 to 3
0.064	3/32 – 1/8	0.040	60	3 to 5	3 to 5
0.072	3/32 – 1/8	0.040	60	3 to 5	3 to 5
0.081	3/32 – 1/8	0.046	56	3 to 5	3 to 5
0.091	1/8 – 5/32	0.046	56	3 to 5	3 to 5
0.128	1/8 – 5/32	0.059	53	3 to 5	3 to 5

OXY-CARBOHYDROGEN

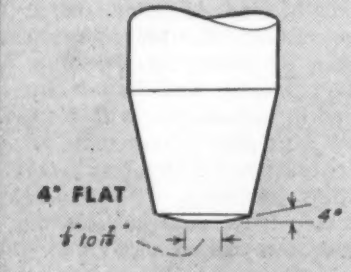
Metal Thickness Inches	Welding Rod Diameter Inches	Orifice Diameter Inches	Drill Number	Oxygen Pressure Lb. per Square Inch	Carbohydrogen Pressure Lb. per Sq. In.
0.020	1/16 – 3/32	0.040	60	1 to 4	1 to 4
0.032	1/16 – 3/32	0.046	56	3 to 5	3 to 5
0.040	3/32 – 1/8	0.059	53	3 to 5	3 to 5
0.051	3/32 – 1/8	0.059	53	3 to 5	3 to 5
0.064	3/32 – 1/8	0.059	53	3 to 5	3 to 5
0.072	3/32 – 1/8	0.059	53	3 to 5	3 to 5
0.081	3/32 – 1/8	0.059	53	3 to 5	3 to 5
0.091	1/8 – 5/32	0.067	51	3 to 5	3 to 5
0.128	1/8 – 5/32	0.081	46	3 to 5	3 to 5

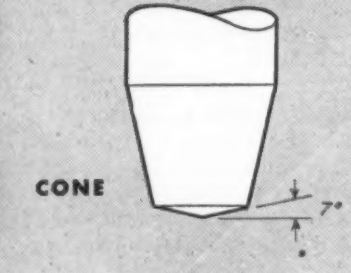


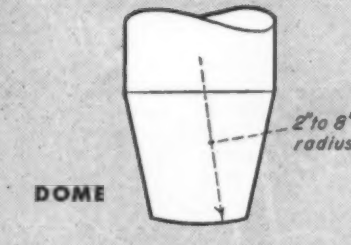




RACKING. Can be prevented by using crap material for starting and stopping or y welding from the center to each end







ELECTRODE TIPS. Contours which can be used for spot-welding magnesium

carbohydrogen (with a mixture of hydrogen and methane) is easily adjusted and has a relatively cool flame. A lightweight aircraft-type torch is usual. Tips should be available with 0.040 to 0.08 in. openings.

The choice of filler rod and the cleaning of rod and surfaces is the same as with arc-welding. The flux is mixed two parts powder to one part water to form a thin paste. The flux is highly hygroscopic (takes on moisture from the air) and should be mixed fresh daily or stored in tightly covered glass containers. Rods should be coated with flux shortly before welding.

With the work in position, the flux is applied on both sides of the edges to be welded. Tacks are welded at intervals of 1½ to 6 in.—the thinner the material the closer the tacks. It is safer to have the flame slightly reducing.

A small section is preheated by fanning with the torch, then the weld is started. The flame is moved forward in a straight line, with the torch inclined at about 45°. At the end of the bead, the torch is played on the work to allow gradual cooling.

If stopping is necessary, the stopping point is refluxed and preheated with the torch before resuming, allowing about ½-in. overlap.

Cleaning must be done as soon as the weld has cooled. First it is washed in hot running water and scrubbed with a stiff bristle brush until all signs of flux are removed. The chrome-pickle treatment is followed with a cold-water wash, then boiling for two hours in a solution of sodium dichromate. This is followed with a cold-water rinse and dip in boiling water. If the weld bead is ground off, the cleaning procedure should be repeated.

Spot Welding

Resistance welding is quite satisfactory with all the alloys. Surfaces must be clean, as with fusion welding, and the same general cleaning methods are possible. Chemical methods of cleaning have been developed that have advantages over the customary mechanical methods.

Sheet with the chrome-pickle finish can be cleaned chemically by dipping in 5 to 10% caustic soda at 150 F. for 5 min., rinsing in cold running water, dipping in 20% chromic acid at 150 F. for 2 min., rinsing in cold running water, and drying. Sheet with the oiled finish is cleaned with solvent, then given the chromic-acid dip.

The equipment should have automatic control of pressure and time and a high current capacity. Standard ac. machines are used, but the dc. stored-energy machines are generally preferred. Equipment can be either the electrostatic or electromagnetic stored-energy units.

Electrodes are made of hard copper alloys, water-cooled to within ⅜ in. of the tip when possible. Design of the tip is important to minimize electrode pickup. Commonest designs are illustrated, with the dome tip preferred.

Spacing of spot-welds is important. The minimum spacing varies with the sheet thickness and nature of the joint from ¼ to 2 in.

The welding cycle must be short, with a high welding current. Adjustment of the machine is important, with trial welds advisable to determine the best setting.

Expulsion of the metal between the surfaces can be prevented by increasing pressure, decreasing current, increasing both pressure and current, or by increasing electrode radius, pressure and current. Expulsion may result from inadequate cleaning.

Electrodes must be cleaned frequently with abrasive cloth to prevent pickup. Proper control of electrode temperature is also important. If moisture condenses on the electrodes, it will cause pickup. A good arrangement is to have a solenoid

SELECTION AND REGULATION OF ARC-WELDING EQUIPMENT

Thickness in.	Current amp.*	Filler rod dia. — in.	Cup size I. D. — in.	Electrode dia. — in.
0.030	20	1/16	7/16	3/32
0.040	30	1/16	7/16	3/32
0.050	35	3/32	7/16	1/8
0.060	45	3/32	7/16	1/8
0.070	55	1/8	7/16	3/16
0.080	60	1/8	7/16	3/16
0.090	65	1/8	7/16	3/16
0.100	70	1/8	7/16	3/16
0.125	75	1/8	7/16	3/16
0.150	80	5/32	7/16	3/16
0.200†	90	5/32	5/8	1/4
0.250	100	5/32	5/8	1/4
0.500	115	5/32	5/8	1/4
1.000	130	5/32	5/8	1/4

*M1 requires 5 to 10 amps. more current up to 0.050, and 15 to 30 amp. more current for thicker material.

†Sheet thicker than 0.150 should be welded in more than one pass; use 60 amp. on first pass and current given in table for subsequent passes.

valve and time relay so water is supplied only during operation.

When welding unequal thicknesses, an electrode of larger contact area should be used against the thicker material to secure even penetration of the weld. Penetration should be 30 to 80% on each part.

In some cases, the faying surfaces are treated with a protective coating as protection from salt atmospheres. Various proprietary mixtures are made for this purpose. In such cases, the material must be squeezed from between the sheets at the weld spot. This means the coating should not be too viscous. It is applied carefully as near as possible to the time of welding. Frequent checks on strength should be made.

All traces of copper must be removed after welding to prevent corrosion. Cleaning is done with aluminum-oxide abrasive cloth, or aluminum-oxide polishing compounds on buffing wheels. This is followed with a chemical treatment, dichromate or chrome pickle, and painting as soon as possible.

Bonding Cements

Several types of bonding cements are commercially available which can be used to join metals, rubber, wood, and plastic. The cements can be used to join magnesium to magnesium or to other substances.

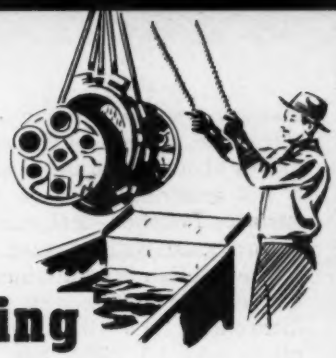
Cements with synthetic-rubber or thermoplastic bases are available which are applied with heat and pressure, while other cements use heat only.

With the heat-pressure method, typical pressures are 300 to 400 psi., temperatures 325 to 350 F., and curing time 15 to 20 min.

The strength of the joints ranges from 1000 to 4000 psi., generally higher than can be secured by riveting or spot-welding. Corrosion resistance is superior with the cements when properly applied. This new method of fabrication has not yet had wide application. Production problems involved with large or irregular work are considerable. As improved techniques of handling the processes are developed, they should see increased application, particularly in bonding magnesium to nonmetallic materials.

Soldering and Brazing

Soldering is not used as a method of joining magnesium alloys. It can be used for filling small surface defects in castings or dents in sheet. With a method being developed, magnesium can be joined by brazing.



Cleaning and Finishing

THE HIGH PURITY of magnesium alloys today gives them good surface stability under ordinary conditions. Like other metals, they will corrode under certain conditions, so for nearly all applications they are given some form of surface finish.

Extensive tests with corrosion have been conducted at the Kure Beach, N. C., test station established in 1935. At this station, thousands of samples of nearly all types of metallic and non-metallic materials have been tested. Magnesium alloys exposed to salt atmospheres as long as ten years have been found in excellent condition, with a thin, dull coating having formed which resisted further corrosion.

The greatest danger of corrosion lies in the formation of galvanic couples. When magnesium is in contact with such metals as steel, copper, and brass a couple is established which, in the presence of electrolyte (such as moisture), will cause severe corrosion. This danger can be eliminated by excluding moisture.

Surface contamination caused during fabrication by the imbedding of foreign particles in the surface will cause galvanic corrosion. Proper cleaning will remove this danger.

Stress corrosion may be caused in a corrosive atmosphere by applied or residual stresses which exceed about half the yield strength. Applied stress is rarely this high, but residual stresses of such magnitude may be found. Such corrosion can be prevented by annealing (preferable) or by protective coatings.

Cleaning

Proper cleaning is very important to remove surface contamination resulting from fabrication. In some cases it is also necessary to remove previous chemical treatment.

Oil and grease can be removed with organic solvents, emulsion cleaners, or vapor degreasers. Chlorinated solvents, petroleum spirits, alcohol, lacquer thinners, and similar materials can be used.

Alkaline cleaning is the most satisfactory method of degreasing, because it will also remove certain previous chemical treatments. Proprietary cleaners of the strongly alkaline type for steel are desirable. The solution should be at least 180 F. and if not boiling, should be agitated. Immersion time is 5 to 15 min. If used as an electrolytic cleaner, the temperature can be 160 to 180 F., and agitation is not required. No soap is necessary for electrolytic cleaning; the work is made the cathode and 10 to 20 amp. dc. per sq. ft. of cathode area is applied. Parts should be rinsed.

Acid cleaning with a chromic-acid solution removes oxide layers, chemical coatings, graphite lubricants, and other materials which cannot be removed with solvents or alkaline cleaners. Parts are immersed from 1 to 15 min. in a bath at 190 to 212 F. made of 1.5 lb. chromic acid and water to make 1 gal. The water must be low in chloride and sulphate.

Acid cleaning with a sulphuric-acid bath is used after sand-blasting. The bath contains 3 parts concentrated sulphuric acid and 97 parts water. On AZ92, the bath should contain 8 parts concentrated nitric acid, 2 parts concentrated sulphuric acid, and 90 parts water. Neither form of acid cleaning can be applied after machining.

Mechanical cleaning methods such as wire-brushing, sanding, and sand-blasting can be used for cleaning. Blasting should always be followed by acid cleaning or by the chrome-pickle treatment. Equipment used for blast-cleaning should be cleaned out periodically to remove magnesium dust.

Chemical Finishing

Chemical treatments may be applied for surface protection, decoration, or both. Considerable study has been given this subject and literally dozens of treatments have been devised; many of these have only slight differences and many have not been used commercially. The discussion here is limited to a few of the methods in common use.

The chrome-pickle treatment (Dow No. 1, AMC No. A) is frequently used as a producers' treatment to protect parts during shipment and storage. It also provides a paint base

and removes flux after gas welding. It can be applied by brush. It removes about 0.0006 in. of surface, so is not generally used on machined surfaces. Polished-steel inserts should be protected with lacquer.

The solution is maintained at room temperature and consists of sodium dichromate 1.5 lb., concentrated nitric acid 1.5 pints, and water to make 1 gal. The dip lasts ½ to 2 min., depending on the freshness of the solution, is followed by a 5-sec. drain over the tank, then a cold-water rinse, and a hot-water dip. It produces a surface that is generally gray to yellow-red. A bright, brassy coating indicates old solution.

Two treatments of a similar nature are the Dichromate (Dow No. 7, AMC No. G) and the Galvanic Anodize (Dow No. 9, AMC No. K). The dichromate treatment is not suitable for M1, while the galvanic anodize can be used for M1 or other alloys. Neither treatment causes any appreciable dimensional change.

The dichromate treatment is applied by a 5-min. dip in 15 to 20% hydrofluoric acid at room temperature (with wrought products a 15-min. dip in 5% sodium, potassium, or ammonium acid fluoride at room temperature can be used—it is more economical and will not attack aluminum rivets). This is followed with a cold-water rinse, then boiling 45 min. in 10 to 15% sodium dichromate, then a cold-water rinse and hot-water dip. The coating produced is brown to black in color.

The galvanic anodize has a first step the same as the dichromate treatment, followed by a cold-water rinse and a 30-min. anodic treatment in a solution with the ratio: ammonium sulfate 4 oz., sodium dichromate 4 oz., ammonium hydroxide 1/3 fl. oz., and water to make 1 gal. Current density should not exceed 10 amp. per sq. ft. of anode. If properly applied, coating is usually black.

The Sealed Chrome-Pickle (Dow. No. 10, AMC No. L) is suited to wrought alloys. Parts are first given the regular chrome-pickle, then boiled for 30 min. in a bath containing 10 to 15% sodium dichromate, and finished with a cold-water rinse and hot-water dip.

Treatments previously described are all comparatively soft. They have good corrosion resistance, but should not be used without further coating if parts are to be subject to wear. They are a good paint base and may be coated with clear lacquer.

A number of anodic treatments have been developed which combine corrosion resistance with varying degrees of abrasion resistance. Anodic finishes can be colored with organic dyes.

In general, anodic finishes do not have as good abrasion resistance as do anodic finishes on aluminum, but they are somewhat cheaper to apply.

In all of the anodic treatments, a sodium hydroxide bath is used. In the Manodyze process small amounts of sodium silicate and phenol are added to the electrolyte and in Dow No. 12, ethylene glycol and sodium oxalate are added. Temperatures vary from 140 to 185 F. for the different processes. Time of anodizing varies from 15 to 30 min. with 10 to 20 amp. per sq. ft. applied at 4 to 6 volts dc. or 15 to 25 amp. per sq. ft. applied at 6 to 24 volts ac. It is advisable if dc. is available to reverse the current for 5 min. before anodizing for cathodic cleaning.

With the AMC treatment R anodize, a sealing coat is applied when the surface is not to be dyed which adds to corrosion resistance and makes a better paint base. The sealing coat is applied by a 30-min. immersion in 5% sodium chromate at 170 to 180 F.

In the Manodyze process, neutralizing is with a 2- to 4-min. dip in chromic acid (0.5 lb. per 100 gal.) at 180 to 200 F.

With Dow No. 12 anodize, there are two possible neutralizing seals. The first is more effective but changes the color to pale yellow. It contains sodium fluosilicate and sodium dichromate and parts are immersed for 15 min. at 70 F. The second seal contains syrupy phosphoric acid and boric acid; parts are immersed for 5 min. at 105 F.

Magnesium alloys can be electroplated. One method is to electroplate with nickel, which can be subsequently plated with chromium, cadmium, or zinc. This method has not been used commercially. Porosity in the coatings has involved danger of galvanic corrosion if the parts are frequently wet in service. A method of electroplating now under development shows promise of practical commercial application without the difficulty encountered in the earlier method. It will apply any metals which can be applied to zinc.

Painting

Most paint troubles are the result of poor surface preparation or poor primers. Surfaces should have suitable chemical treatment before painting. Clean with solvent just prior to applying the primer.

Zinc-yellow primer with controlled chloride and sulphate content is desirable and is available from a number of paint manufacturers.

For finish paints, quick-drying lacquer or synthetic-resins are usually used for production speed. Oil-type paints are quite satisfactory, however. A variety of lacquers, enamels, and varnishes which are suitable are available.

Baked finishes can be used over suitable baking primers with either ovens or infra-red lamps for baking. Heat-treated or hard-rolled alloys or forged or extruded AZ80X can be heated to 350 F. for 1 hr. with safety, except hard-rolled AZ31X, which should not be heated above 260 F. Temperatures for one such finish are 250 to 450 F., with time varying from 10 min. to 2 hr.

Chemically colored or buffed magnesium surfaces have a pleasing finish for many applications, but require a clear coating for protection from wear and tarnish. One to three coats of clear lacquer are advisable.

Several clear finishes have been developed for magnesium. The first of these is a Saran formulation designed for interior use. The coating is humidity-resistant. The surface is sanded or polished and the coating applied by brush or dip. The coating can be air-dried or baked at 140 to 180 F. for 30 to 60 min. Only a single thin coat is required.

The second is a methacrylate material for exterior use. It can be dyed or pigmented if desired. The material is preferably applied by brush or dip, but it can be sprayed. Two coats are advisable. When applied over bare magnesium, it stays bright for one to three months. If a chemical treatment is applied first, it lasts much longer.

The third is an alkyd melamine baking synthetic resin. It is used on bare rough surfaces for interior use, is not applied to buffed surfaces.

WE ACKNOWLEDGE... *the valuable assistance in collecting the data for this report given by the following firms and organizations. Special thanks go to Prof. O. W. Boston of the College of Engineering, University of Michigan, whose research has contributed greatly to the knowledge on machining magnesium, for his help.*

American Magnesium Corp.
Brooks and Perkins
Dow Chemical Co.
Eclipse-Pioneer Division, Bendix Aviation Corp.
Factory Mutual Laboratories
General Electric Co.
Gray Manufacturing Co.
Heresite & Chemical Co.
Hills-McCanna Co.
Linde Air Products Co.
Magnesium Association
Magnesium Co. of America
Revere Copper and Brass, Inc.
Wyman-Gordon Co.

ROUND TABLE

Is Apprenticeship Slipping?

"For a journeyman machinist, that Sam Jones sure knows less than any guy I've ever hired, Al. He's got the papers and the toolbox, but he's a dub when it comes to doing any job out of the ordinary."

"Maybe Sam is just one of those boys who aren't handy, Ed. Maybe he should have been a butcher or a clerk instead. He must have served his time to get papers, and that's a pretty good course of sprouts."

"It wasn't for Sam. He's smart and handy—picks up anything he's told and does a good job. It's just that I have to tell him every new thing, except on a lathe or a drillpress."

"Sounds like they made a specialist out of him. What did he do—spend four years learning to run two machines?"

"Something like that, Al. It's a cinch he didn't have an old-fashioned apprenticeship. Why, I had to learn to run everything in the shop, and do all the bench and outside jobs, too, before I was through."

"Yeah, Ed, they made a good mechanic out of you, but they didn't teach you much of anything else. You could do with some geometry, algebra and trigonometry, among other things."

"That's right, Al, but I had to go to work before I had a chance to get 'em in school. I even left the farm and moved into the boss's house in town, so I had to help out there with the yard and the barn."

"You were an apprentice like they used to have in the Middle Ages, Ed—no time off for anything. What's more, I'll bet you served your time with the same boss all the way through and no special classes like the boys have now."

"That's right, but the boss used to pump what he knew into me every chance he got. He treated me like one of his own kids. I learned a heck of a lot more than just shop work."

"Maybe so, Ed, but you didn't get trained by specialists on each machine, and you didn't get the other special training they give now. They divide responsibility nowadays, so an apprentice really learns each part."

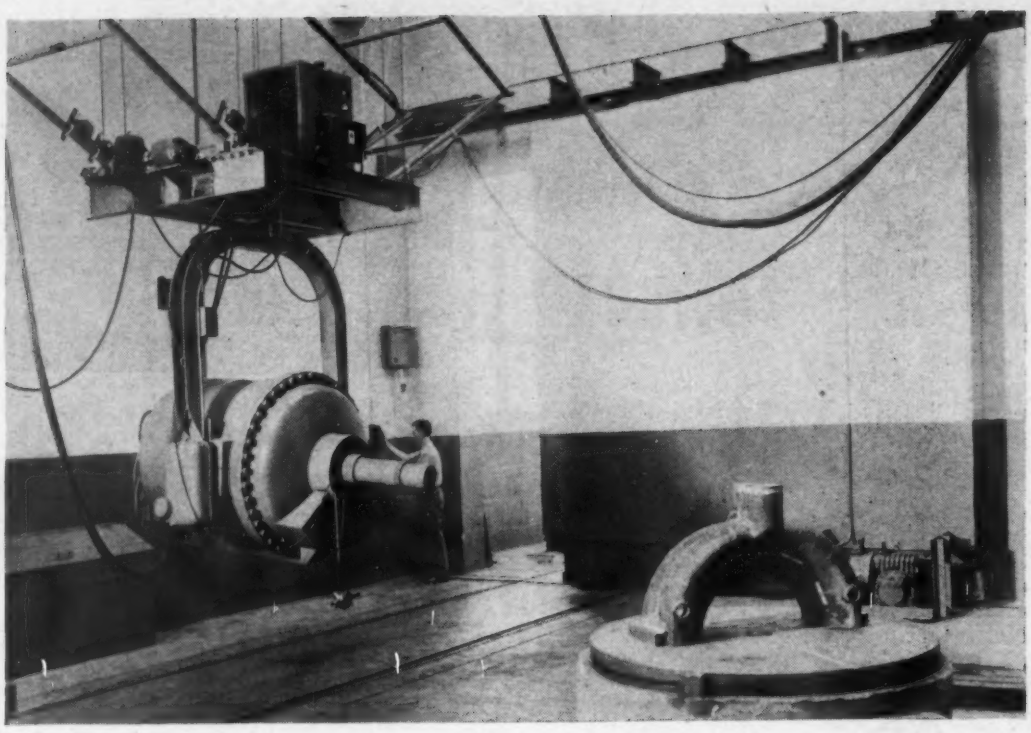
"Yeah, and never gets the parts together! I had to live with my boss, so I got lots more than technical training. He taught me how to live—how to make my money last, how to get along with people, where church and living fit in. These kids get the shop training—such as it is—but it doesn't fit together."

"Sam didn't even get the shop training, from what you say, Ed. Sounds like the pieces they taught him don't fit the rest of the puzzle. He got a half-baked training, not a planned one like those they have in big plants."

"I'd never apprentice any kid of mine in a big plant, Al. They've got everything so well planned out that nothing ever goes wrong. The kids don't learn to think for themselves—it's like going to a lecture course. You've got to run smack into trouble to learn how to handle it—and your kind of apprentice never gets any trouble."

"And your kind gets only what his boss knows. You had a good boss; Sam had a bad one. You learned a lot; Sam didn't. It isn't fair to a kid to make him take that chance."

***IS APPRENTICESHIP** as good as it was? Which is the better system, the integrated one in which the boy learns his skill and his philosophy from one boss, or the planned one in which specialists do the training? Your ideas and experiences on this subject will help other readers. Discussions of earlier topics appear on later pages.*



CASTINGS weighing up to 5 tons are placed on 5-ft. rotary tables for ease in bringing desired inspection areas in front of the 1,000,000-v. X-ray tube. Inspector is about to close lead - shielded heavy door giving access to casting-preparation area and will leave by another door interlocked with the X-ray machine circuit

Radiographic Inspection

FITS INTO WORK-PROCESSING SCHEDULES

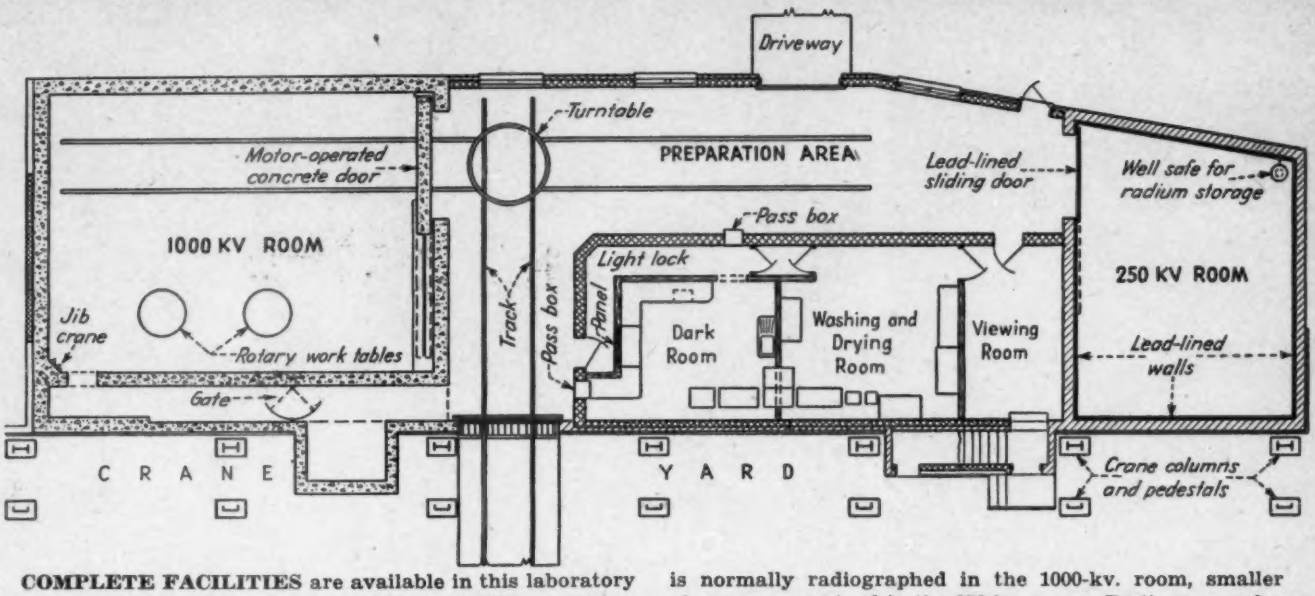
Smaller castings are laid out in the inside preparation area; heavier ones are handled in a crane yard, then brought inside on a flat car

BY RUPERT LE GRAND
ASSOCIATE EDITOR

Prompt, economical surveys of castings and weldments are made when X-ray installations are planned for quick handling of work, film and defect analysis

MANY PROCESS SHEETS written at the Steam Division, Westinghouse Electric Corporation, So. Philadelphia, call for radiographic inspection of the part concerned—a casting, weldment or forging as the case may be. And processing divisions, notably the foundry, require X-ray inspection to improve their methods.

In fact, in these two categories, this 12,000-man plant has so much work for which soundness of metal is important, that a specially designed X-ray laboratory was built. This shop, as it can be called, is located strategically with



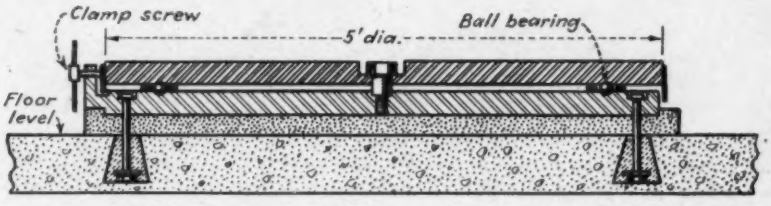
COMPLETE FACILITIES are available in this laboratory for examining castings and welded assemblies weighing up to 10 or more tons and in any thickness of section likely in steam-turbine work. Bulky, heavy-section work is normally radiographed in the 1000-kv. room, smaller pieces are examined in the 250-kv. room. Radium capsules are employed when it is desirable to expose a number of films at once and avoid manipulation of the piece

respect to the machining divisions. To it, come all of the parts that can be moved conveniently, namely items weighing from a few pounds up to 10 tons or more. Large, welded drums and similar articles are X-rayed in the manufacturing divisions by means of mobile equipment.

Like any other department, work flow in the X-ray laboratory is scheduled and adequate records are kept. Castings arrive in the rough-machined condition. Purposes of a radiographic inspection are: (1) to detect internal flaws before finish machining, thus affording an opportunity to chip out repairable defects and weld them, and (2) to improve foundry practice. Reports on each job are made to the processing divisions concerned.

Regardless of size, all incoming castings or weldments are assigned an X-number from a consecutive record. The X-number card bears such information as shop order number, date, identification of part, test number, heat number, drawing number, pattern number, purchase order and vendor, if the piece is purchased.

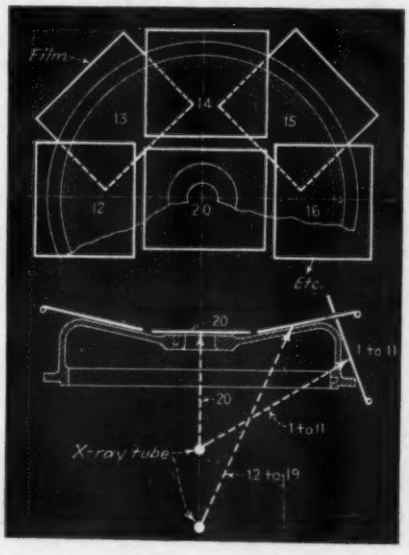
Smaller pieces are trucked to the inside preparation room, bulky parts are brought to the crane yard by flat car. In either case, the casting is cleaned, the X-number is steel stenciled and the work of laying out for the radiographic survey is done. The laying-out process consists of marking the blueprint with areas at which films should be applied in order to locate suspected defects, and marking these areas with consecutive film numbers (see sketch of typical layout). Then the casting is similarly



ROTARY WORK TABLES are fitted with a large ball thrust bearing for easy positioning of heavy loads in front of the 1000-kv. X-ray tube

marked with chalk and the film numbers are steel stenciled. Much of this layout work can be handled by shop personnel after experience, but the head of the radiographic department and the shop frequently give instructions.

LAYOUT for a radiographic survey consists of marking the blueprint with locations for application of films and stamping corresponding numbers on the casting or weldment

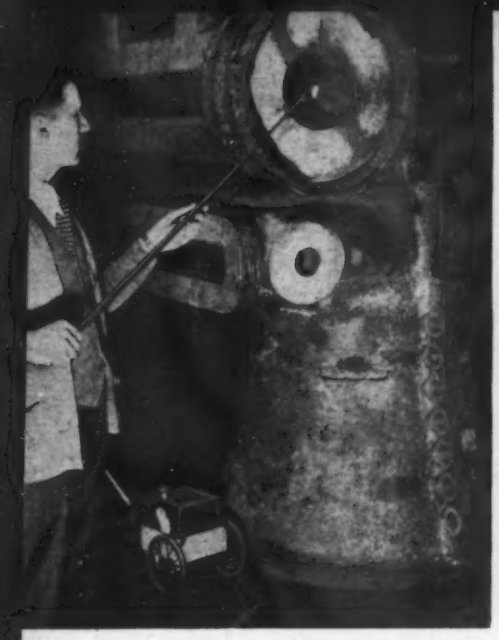


Selection of radiographic technique depends on the size of the piece and metal thickness. The 250,000-volt machine often is used for smaller pieces and thinner sections. Bulky parts are put on a special flat car by the yard crane and are moved into the 1,000,000-volt room. Here the casting may be placed on either of two 5-ft. diameter tables, or merely left on the car if too heavy for the overhead crane.

The work tables, of course, can be rotated to position the part at will in front of the X-ray tube, and have been found a great convenience in reducing handling.

Radium capsules are often used, despite the two X-ray machines. Reasons are: (1) capsules are the only means of applying X-radiation in cavities too small or too deep for X-ray tubes, (2) many films wrapped about a large boss can be exposed simultaneously, and (3) similar parts can be grouped symmetrically about the capsule and the films for each exposed. So even in a large laboratory, radium still has important uses.

A storage vault for radium capsules is located in the 250-kv. room. The vault is 30 ft. underground so that stray radiation cannot effect personnel or stored film. For conveni-



EXAMINATION of heavy bosses is best done with radium capsules. X-ray films are strapped around the boss

LEAD SCREENS on dollies permit setups to be made in booths of the 250-kv. room while other workpieces are being shot with a mobile X-ray machine. Note motor-operated well safe for radium storage (30 ft. underground)

ence, the lead safe is lifted from the vault and returned to it by a motor-operated hoist equipped with limit switches for travel control.

The 250-kv. machine is a mobile type, so that setups can be X-rayed in any part of the room. Here, workpieces are usually handled on pallets. Lead screens mounted on wheeled carriages are positioned around the pallet when exposures are to be made. Thus, the X-ray machine and radium capsules can be used at will without exposing operators to harmful radiation.

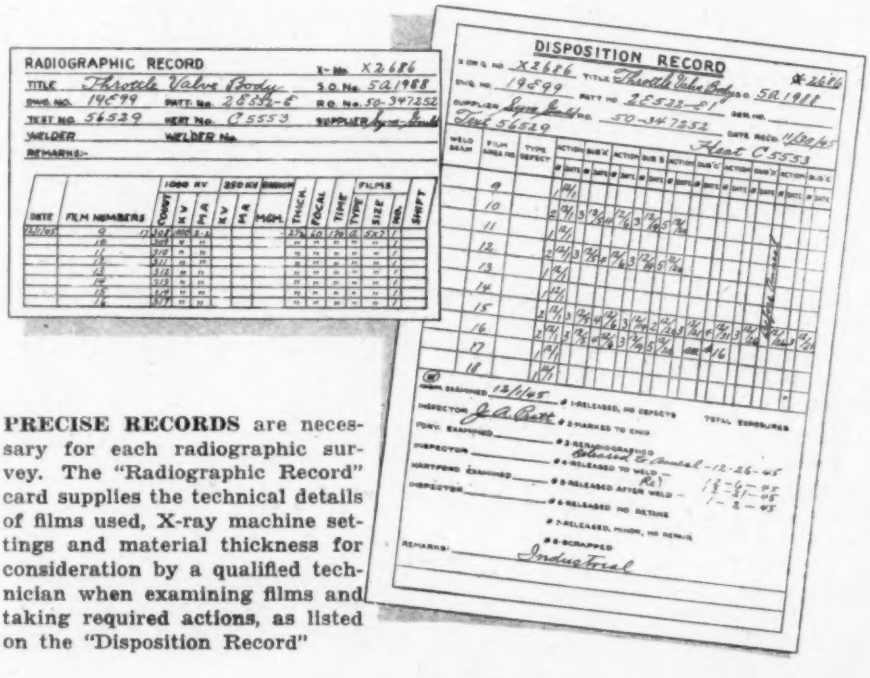
To eliminate errors from possible defects in film, the double-film technique is used. Two X-ray films, 5x7, 10x12 or 14x17, are interposed between three sheets of lead 0.010 in. thick, forming a light-tight package. Use of two films gives required density, cuts down exposure time, gives more latitude for changes in metal section. Thus, an Eastman *A* film may be assembled with a *K* film. The *A* film has proper characteristics to record defects in thin sections, the *K* film handles heavy sections; and the two together cope with intermediate thicknesses.

In the 1,000,000-volt X-ray room, several means have been worked out to reduce effort and setup time; namely: (1) the two work tables or positioners, (2) devices to apply or position film-holders, or cassettes, at the laid-out areas and, (3) modifications of the X-ray machine support to provide more latitude in positioning the tube.

Proper support of the heavy, lead-covered cassettes is a problem. Cassettes are affixed to the work or positioned in proper relation to the laid-out areas by trunk straps, blocks, hinged clamps, carpenter's clamps, telescoping spring clamps or jacks, and racks having inclined slots at various levels. These devices, especially the homemade ones, have proved helpful in reducing setup time.

Several methods are used for holding cassettes against the interior of cavities or large rough-bored holes. The hinged clamp with torsion spring is compressed by hand and slipped between the cassette and the opposite side of the hole. For larger bores, the telescoping spring clamp or jack is good. And when large tubular objects are involved they are laid on their side, and a wood frame is inserted. Top face of the frame is curved to fit the hole. Cassettes are laid on the frame, and the frame is blocked up.

The X-ray tube is connected with tilting and turning arrangements that permit it to be brought down to 3 ft. from the floor when in the vertical position and 2 ft. in the horizontal position. The tube can be swung 270° and the yoke is motorized to save time and effort in lowering and raising the tube. In addition, a protractor is fitted to the trunnion so the tube can be positioned quickly at right angles to the work contour.


RADIOGRAPHIC RECORD

X-Ray No. X2686
TITLE Throttle Valve Body
S.O. No. SA1988
DWG. NO. 19599
PATT. No. 2E532-E
P.O. No. 50-347252
TEST NO. 56529
HEAT No. C5553
SUPPLIER Lynn Foundry
WELDER
WELDER No.
REMARKS:-

DATE	FILM NUMBERS	1000 KV COUNT	1000 KV KV	1000 KV MA	250 KV KV	250 KV MA	EMISSION MGH.	THICK.	FOCAL	TIME	FILMS TYPE	FILMS SIZE	FILMS NO.	SHIFT
12/1/45	9	17	400	2-2				3¾	40	120	A	5x7	1	
	10		3/4	"	"	"	"	"	"	"	"	"	"	
	11		1/2	"	"	"	"	"	"	"	"	"	"	
	12		3/4	"	"	"	"	"	"	"	"	"	"	
	13		3/4	"	"	"	"	"	"	"	"	"	"	
	14		1/2	"	"	"	"	"	"	"	"	"	"	
	15		1/2	"	"	"	"	"	"	"	"	"	"	
	16		1/2	"	"	"	"	"	"	"	"	"	"	

DISPOSITION RECORD

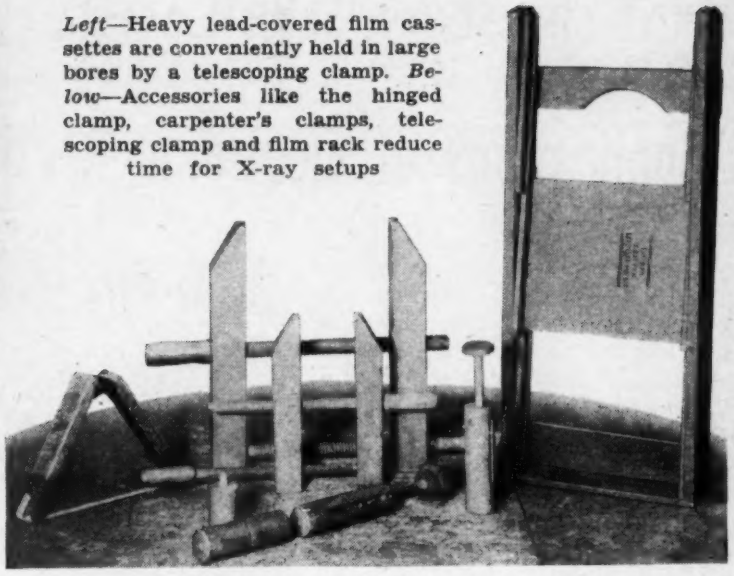
X-Ray No. X2686 TITLE Throttle Valve Body S.O. No. SA1988
DWG. NO. 19599 PATT. NO. 2E532-E1
SUPPLIER Lynn Foundry P.O. NO. 50-347252 ORD. NO.
TEST 56529 DATE RECD. 11/26/45 HEAT C5553

WELD SEAM	FILM AREA NO.	TYPE DEFECT	ACTION	SUB 'A'	ACTION	SUB 'B'	ACTION	SUB 'C'	ACTION	SUB 'D'	ACTION	SUB 'E'
	9		OK									
	10		OK									
	11		OK									
	12		OK									
	13		OK									
	14		OK									
	15		OK									
	16		OK									
	17		OK									
	18		OK									

Heat C5553

ITEMS EXAMINED 12/1/45 # 1-RELEASED, NO DEFECTS TOTAL EXPOSURES
INSPECTOR J. A. Scott # 2-MARKED TO CHIP
TOTAL EXAMINED # 3-RERADIOGRAPHED
INSPECTOR Released C. Samuel 12-26-45
TOTAL EXAMINED # 4-RELEASED TO WELD
INSPECTOR Ray 12-6-45
TOTAL EXAMINED # 5-RELEASED AFTER WELD
INSPECTOR 1-8-45
6-RELEASED NO RETAKE
7-RELEASED, MINOR, NO REPAIR
8-SCRAPPED
REMARKS: Industrial

PRECISE RECORDS are necessary for each radiographic survey. The "Radiographic Record" card supplies the technical details of films used, X-ray machine settings and material thickness for consideration by a qualified technician when examining films and taking required actions, as listed on the "Disposition Record"



Left—Heavy lead-covered film cassettes are conveniently held in large bores by a telescoping clamp. *Below*—Accessories like the hinged clamp, carpenter's clamps, telescoping clamp and film rack reduce time for X-ray setups

Finally, a spot light and a powerful condensing-lens system are clipped to the tube, so that the latter's axis can be located exactly at the center of the film area.

Exposure technique is read from charts or taken from the blueprint, if marked thereon. In other words, the operator must place the tube at a suitable distance from the work and determine the tube current and time according to metal thickness. Often the layout man in the preparation area will specify focal distances in relation to certain films. When the setup has been made, the personnel withdraw to the control panel outside the 18-in. concrete wall surrounding the 1,000,000-volt X-ray room. Numerous safeguards have been established to insure worker safety. Details of each exposure are written on a Work Card, which stays with the piece until final disposition is made.

Exposed cassettes are handed into pass boxes in the walls of a light lock surrounding the darkroom. Cassettes are unloaded in the darkroom, the film developed in temperature-controlled tanks and put into a through-the-wall fixing tank. Operators in the light room remove films from the tank, wash and dry them.

Film reading is done by qualified personnel in a separate viewing room. The two films for each exposure are matched from marker indications (round lead markers are placed on the outside of the workpiece, square ones on the inside) and viewed on a powerful light screen. Defects are noted on a Disposition Record. At the same time a Permanent Technique Record is filled in, covering the data on the operator's Work Card.

Standards are set up for the size, location and nature of defects where repetitive parts are concerned. No part is perfect, the standards represent the judgment of the radiographic head, engineers and the shop concerning defects which are important and those which are not. On new jobs, the radiographic head must render an opinion.

If a defect, such as a shrink, is seen in the film, the casting is returned to the shop for chipping, repair welding and stress relieving. Repaired areas are again X-rayed. This process is repeated until sound metal is revealed. Then the part is released to the shop for finish machining. Weldments are handled in a similar manner. Forgings, especially those for rotors, must meet the standards set up; no repair is permissible.

DEVELOPING TANKS in the darkroom are kept under close temperature control. At left of operator there is a hypo tank (black hinged lid) into which operator places developed films. And from which operator in washing and drying room removes them for final processing

Reduce Labor at Presses

THERE is no reason why a press need be stopped to remove a cumbersome stamping, and there is also no reason why two or more helpers are used for the purpose. Mechanical "hands" will perform the same work rapidly and safely in step with press operation. Automatic oiling of blanks also saves labor.

Applications of Electronic Rectifiers

KENOTRONS are used in applications requiring high voltage but low current. Because of their simplicity and low cost they are also used for many small dc. power requirements. Thus, kenotrons of varying sizes fit the low-power classification.

Many sound slidefilm amplifiers employ a kenotron in a rectifier circuit and a filter system to supply a smooth dc. voltage for the sensitive amplifier.

The kenotron is found as a full-wave rectifier supplying the dc. voltage for the timing and control circuits which assure high accuracy in resistance welding.

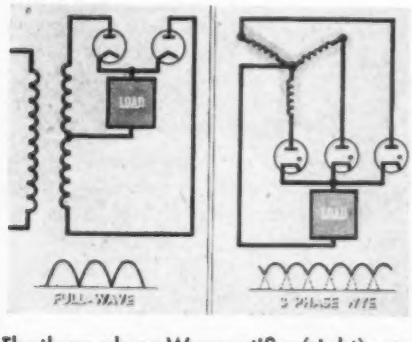
It supplies the necessary dc. voltage for a photoelectric relay, in which high sensitivity and fast response are required.

The phanotron resembles the kenotron tube, but contains an inert gas or mercury vapor instead of a vacuum. This gas produces ionization, which aids the current-carrying properties of the tube. As a result, gas-filled tubes conduct high current with low voltage losses.

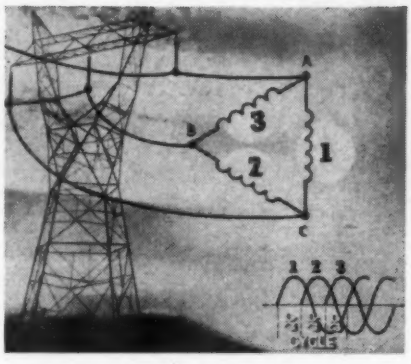
In general, phanotrons have moderate anode current ratings, ranging from one-quarter to twenty amperes, according to size and specified duty.

Although the phanotron is often used on single-phase ac. power, this type of tube is frequently operated in rectifiers using three-phase power. It is more economical to generate and distribute three-phase power, which uses three wires for its transmission.

The familiar single-phase ac. voltage can be obtained from any two



The three-phase Wye rectifier (right) uses three secondary windings and tubes



Each of the phases of three-phase power is displaced one-third of a cycle to give a more uniform voltage

of the three wires. The transformer primary is connected between lines *A* and *C*, thus furnishing the secondary with single-phase power as shown by the voltage wave. To establish a clear relationship of phases, this phase will be called the number one phase. Its transformer windings will be shown vertically.

Now, if a second transformer primary is connected across lines *B* and *C*, a second phase will be available which starts its cycle a little later than the first phase. This is shown on the curve displaced one-third cycle or 120 deg. behind the first phase. Note that the number two phase connections are shown slanted at this angle.

To obtain a third phase, another transformer primary can be connected across lines *A* and *B* at this angle. Also note on the curve below, that the third phase is displaced another third of a cycle behind the second phase. There are now three phases of ac. power, spaced uniformly in time, available from the secondaries of our three transformers. Any one of the three phases may be used as single-phase power, such as has been used previously, or all three phases may be employed by properly connecting all three secondaries in a common circuit.

To form a three-base Wye rectifier circuit one end of each transformer secondary is connected together and the other end is connected to one side of the load. The opposite ends of the transformer secondaries are each connected to an anode. In this circuit, each one of the three tubes supplies the common load with current for one-third of the time. Conduction begins when a tube's anode becomes more positive than that of the preceding tube.

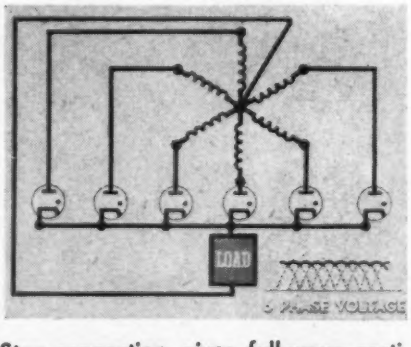
This system is similar to the familiar single-phase full-wave system with the exception that here three secondary windings and tubes are used instead of two. Note that this dc. output is more uniform than that produced by a single-phase full-wave circuit.

We can increase the number of phases by connecting two windings from each phase to the common load, so that now both half-waves of each phase can be used. This type of secondary connection is called a "star," because of its shape, and produces the effect of a six-phase voltage.

By connecting this transformer into a circuit employing six rectifier tubes, there will be effect of full-wave rectification on each of the three phases. This system supplies a dc. voltage that is much more uniform than that of the three-phase, Wye system, but each tube carries the full current one-sixth of the time.

A variation of the six-phase circuit splits the six secondaries into two separate three-phase rectifiers in which each tube carries current one-third of the time. Since a tube from each of the two groups now conducts at the same time, double current results. The interphase transformer is connected between the midpoints and the load and helps to divide the current equally between the two units.

Based on a sound slidefilm in the General Electric industrial electronics course.



Star connection gives full-wave rectification for each of three phases

Practical Ideas

Toolmaker's Button and Swivel-Base Trammel Speed Layouts

S. FRAMURZ

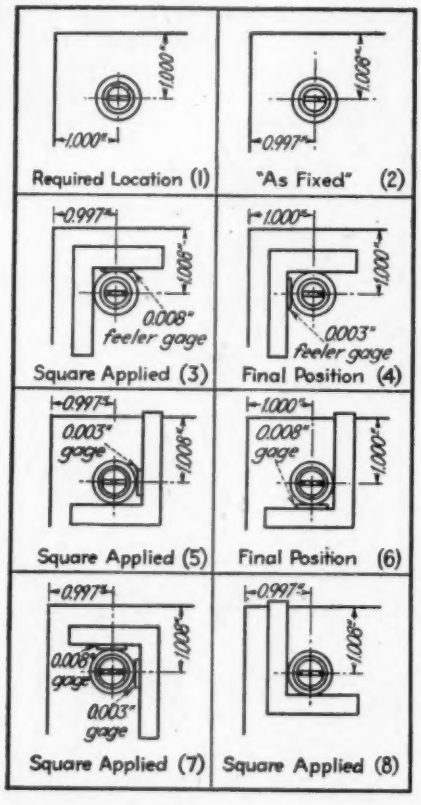
One of the commonest methods of accurately locating boring work on the faceplate of a lathe is what is known as the "Button Method." As many toolmakers buttons as there are holes to be bored are fastened on the work with screws engaging previously tapped holes and then precisely set to the exact center distances required by means of micrometers or vernier height gages. Each button, by turn, is then trued on the lathe faceplate with a dial indicator and when running dead true is removed and the hole drilled and bored to size.

The only drawback of this method is that the buttons have to be set to their correct location by a cut and try method of repeated measurements and adjustments which involves considerable time in the toolroom. To overcome this drawback I have evolved the following method by means of which settings have been completed in just a fraction of the time it took with the usual method.

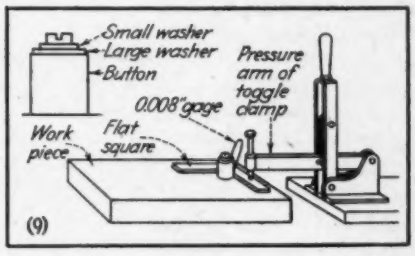
Briefly, the method is to measure the "as fixed" position of each button with relation to other buttons or to the reference edges of the work, and find by exactly how much the button should be shifted to locate it in the desired position; then, using a feeler gage and reference coordinates in the form of a flat square, the required shifts are made at a single setting, locating the button in its required position at once. An example will serve to demonstrate the procedure.

Suppose that a button is required to be located exactly 1.000 in. from either of two reference edges of a workpiece (Fig. 1). On fixing the button, the random dimensions are found to be, say, 1.008 in. vertical and 0.997 in. horizontal (Fig. 2). Hence, corrections to be applied are 0.008 in. vertical and 0.003 in. horizontal. If we could now shift the button 0.008 in. up and 0.003 in. to the right it would be located precisely 1.000 in. from either edge as required. To do this a small flat square (not necessarily a precision one) is laid as in Fig. 3, its vertical arm touching the button, and an 0.008-in. feeler (1.008 — 1.000) interposed between its horizontal arm and the top side of the button. The square is now locked by any convenient means (see Fig. 9) without disturbing its position in the least. Next, the button is loosened, the 0.008 feeler is removed and an 0.003 is held against the vertical arm of the square and then the button is moved so that its top side touches the horizontal arm and its left side touches the 0.003 feeler. It will be seen (Fig. 4) that the button is now exactly 1.000 in. from both edges of the workpiece and can be fixed finally and the square and feeler gage removed, for use with the next button.

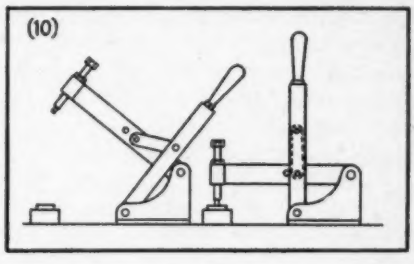
Besides the position shown in Figs. 3 and 4 there are three other positions in which the square could be applied to the button to effect the necessary location, as shown in Figs. 5 to 8. But not all of them are convenient from a practical point of view. Thus, the position indicated in Figs. 5 and 6 is as convenient as that in Figs. 3 and 4 because in either case only one feeler gage is required. But not so with positions of Figs. 7 and 8. If the square is applied as in Fig. 7, two gages, one 0.008 in. and another 0.003 in., will have to be interposed simultaneously before the square is locked; if position of Fig. 8 were used, in the first instance, the square is locked without gages but it is necessary to interpose the two gages simultaneously when refixing the buttons. Simultaneous application of two gages is awkward and likely to admit inaccuracies; such positions should therefore be avoided. Whatever the value of the corrections, the square could, in all cases, be so placed that only one feeler gage need be used at a time.



Feeler gage adjusts toolmaker's button horizontally and vertically from the trial or as fixed positios using a try square as the reference



A toggle clamp holds the square



As regards the method of locking the square, this should be such that the square does not shift either while being locked, or thereafter. This is an essential condition. I have found a toggle clamp, as illustrated in Figs. 9 and 10, invaluable for this purpose. When taking measurements, its pressure arm can be raised quite out of the way, while a pull on the handle can instantly bring it down with a positive locking pressure upon the square without disturbing its setting.

When using the above method for the first time, if the buttons fail to locate after a single setting, one or other or both of the following may be the cause: The screw at the end of the pressure arm of the toggle clamp is not correctly adjusted. This should be so adjusted that it touches the square only just before the toggle reaches its dead center. If it touches the square much in advance the latter will be dragged out of its setting; if it touches the square rather late, the square will not lock properly and may shift subsequently. The second cause may be the shifting of the button itself while being screwed down in its final position. To make this impossible my method is to use two washers under the tightening screw as in inset Fig. 9. One washer is about the diameter of the button, the other somewhat smaller. Both are cut out of 18-gage stainless steel stock, one side of which is descaled and the other mirror bright. The big washer is laid on the button with its bright side up. The small washer is then laid over it with its bright side down after smearing a little oil on this side. The two polished surfaces in contact, the presence of an oil film, and difference in the areas of contact owing to the smaller size of the top washer, all combine to ensure that, however firmly the screw is tightened only the small washer turns without in the least disturbing the large washer or the button under it.

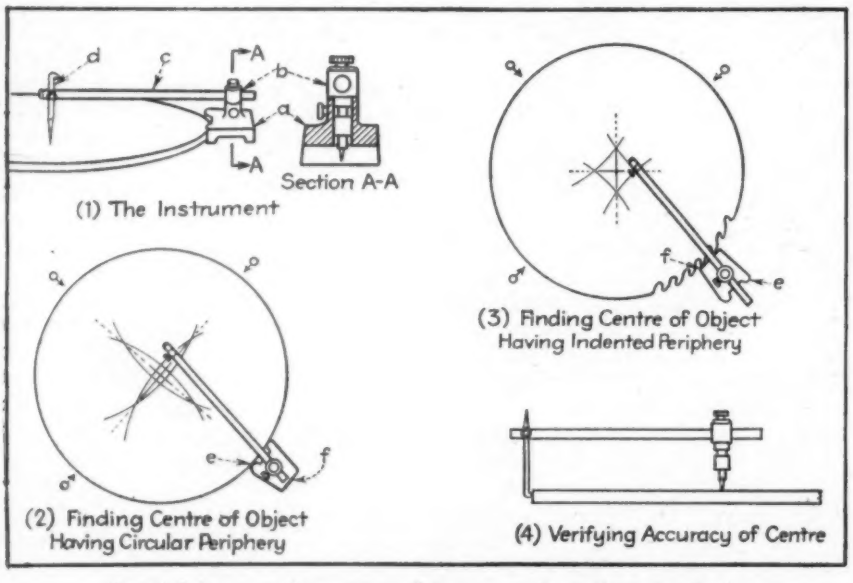
Swivel-Base Trammel

A modification of the conventional trammel, the instrument shown in Fig. 1, is capable of determining centers of circular objects, quickly and accurately. It consists of a base (a) in which pivots the inner leg (b) carrying the beam (c) which itself carries the outer leg or scriber (d). The pivot portion of the inner leg (b) is ground and lapped to fit the hole in the base.

To find the center of an object the base is pushed against its periphery (Fig. 2) and an arc is described with approximately the radius of the object. Three more arcs are described with this same radius but from points about 90° apart. If the arcs fall beyond the center, they intersect as in Fig. 2. If they fall short of the center they would intersect as in Fig. 3. In either case the common point of the lines joining the opposite intersections of the arcs would give the true center of the object. The accuracy of this center may at once be verified by lightly popping it and applying the point of the inner leg (after removing the base) and scanning the periphery with the blunt end of the scriber, as in Fig. 4. A more accurate check is possible if the scriber is replaced with a dial indicator suitably mounted so that its contact point bears against the periphery of the object.

When the object has a smooth circular periphery the side marked (e) of the base is used as in Fig. 2, while for work having indented periphery such as saws, gears, milling cutters, etc., the straight side (f) is used as shown in Fig. 3.

With the scriber point down, and the base removed, the instrument can be used as a pair of trammels.

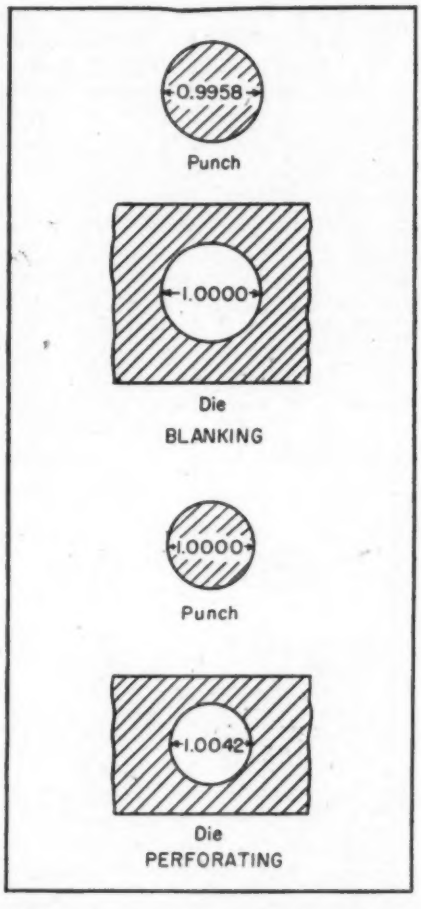


Special base makes trammel into a universal center-finder

Grind Punches and Dies With Proper Allowances

JACK ADAMS

In presswork on thin flat stock you want one of two things—in the first case, the stock has to have a hole cut in it. The piece is called the blank and the circular piece punched out and rejected is called the slug. This process is called blanking. In



When the work has a hole punched in it, you call it blanking. When the work is punched out of the stock, it's perforating

the second case you want the "slug" so it becomes the blank and the surrounding stock cutaway becomes scrap. This is perforating.

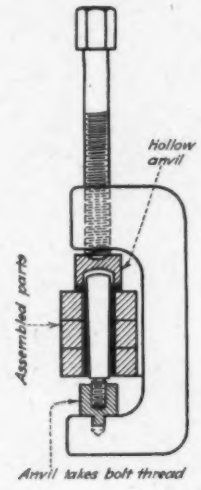
The punch and die set used for punching a 1-in. hole will vary in two respects depending upon which piece is to be saved and which scrapped. First in importance is size. The punch will always push out a piece very nearly its own size while the hole will be the size of the die. So, in blanking the die establishes the work size and in perforating, the punch does it. Second, it is desirable to leave all the burr on the scrapped piece.

Taper-pin Puller Made From C-clamp

JOHN P. POKRYFKI
Naval Air Station No. 128

Addition of special anvils to suit individual needs makes any C-clamp into a convenient and effective puller. Taper pins, dowels, and bushings near the edge of a unit which can't be driven from beneath are started by pressing with a cup anvil around the pin. The advantage of this over an arbor press is its portability, permitting work, especially repair work on large assemblies.

The job in this particular case was a taper pin having a small threaded stud attached. This couldn't be punch-driven because of possible damage to the threads. A special anvil tapped to take this screw was made, and then any pressure can be exerted without danger. *Suggestion submitted under the Navy Employees' Suggestion Program.*



C-clamp with special anvils becomes a portable or pin bushing puller

Floating Air Cylinder Gives A Two-Way Squeeze

L. KASPER

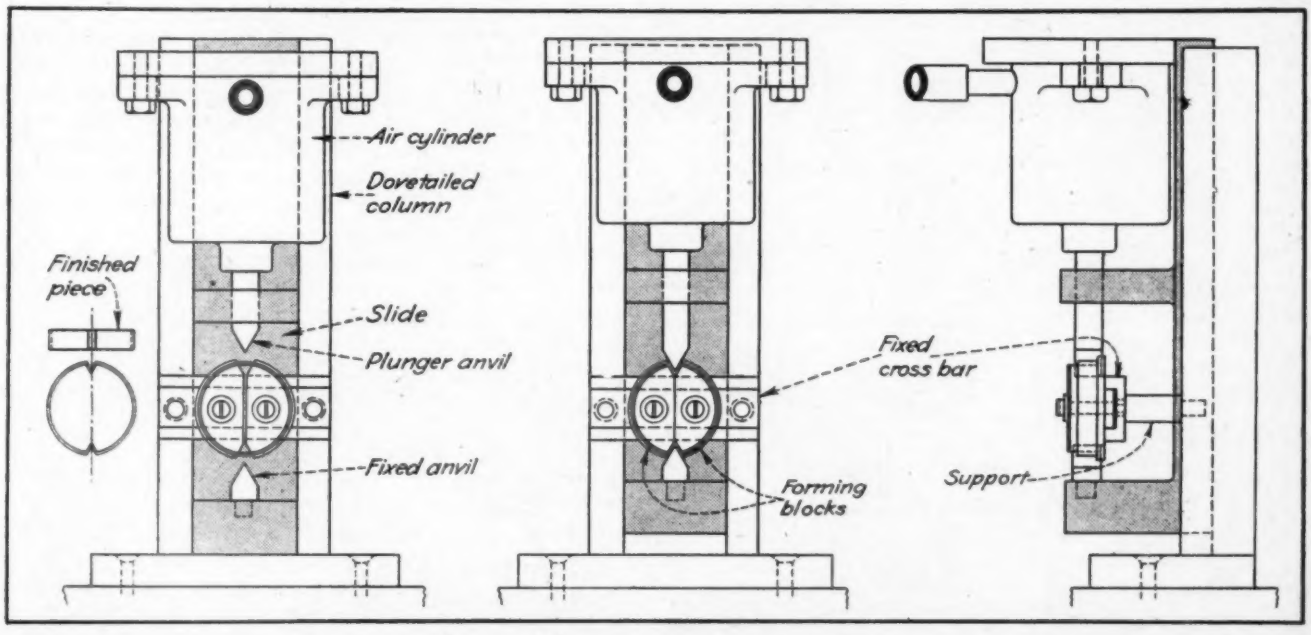
Rings of soft brass tubing had to be symmetrically formed into an ellipse with two V-notches diametrically opposite. Rather than make some sort of indexing fixture to do this notch-bending, we felt it would be just as simple and much faster to force two anvils in at once and complete the piece in a single operation.

The press consists of vertical dovetail ways with a fixed crossbar mounted on two projecting studs. In the ways is a floating slide which carries the air cylinder at the upper end and the fixed anvil at the bottom. The forming blocks are loosely mounted on the crossbar with shouldered screws and are flanged on their rear faces to square the tube section.

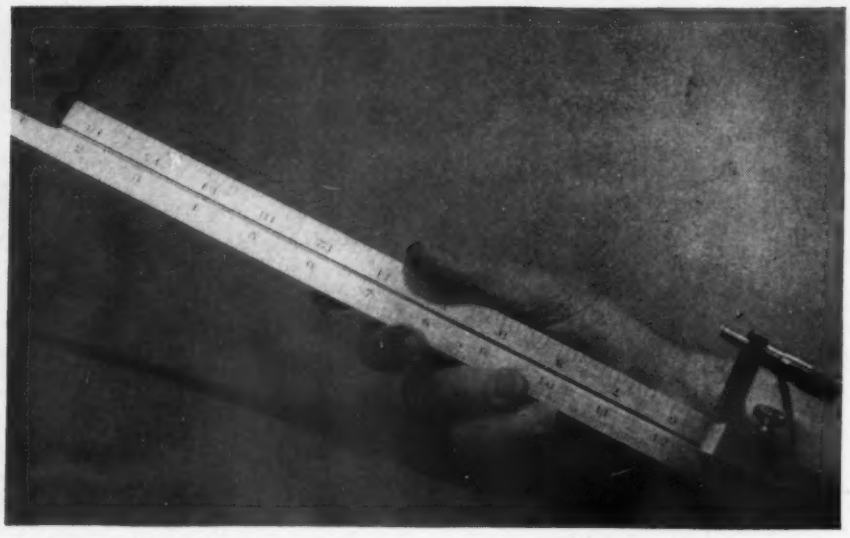
The piece of circular tube is fitted over the blocks and the air is turned on. This brings the top anvil, which is an extension on the piston rod, against the brass, but the reaction of the cylinder itself lifts the whole slide with the same force that the piston and anvil is exerting downward. This brings the lower, fixed anvil into the bottom of the brass tube and both indentations are made simultaneously with equal pressure (except for the weight of the slide and cylinder and piston, all of which acts downward.)

As the forming progresses, the tension in the metal caused by stretching it into the notch draws the blocks together and the ellipse is formed.

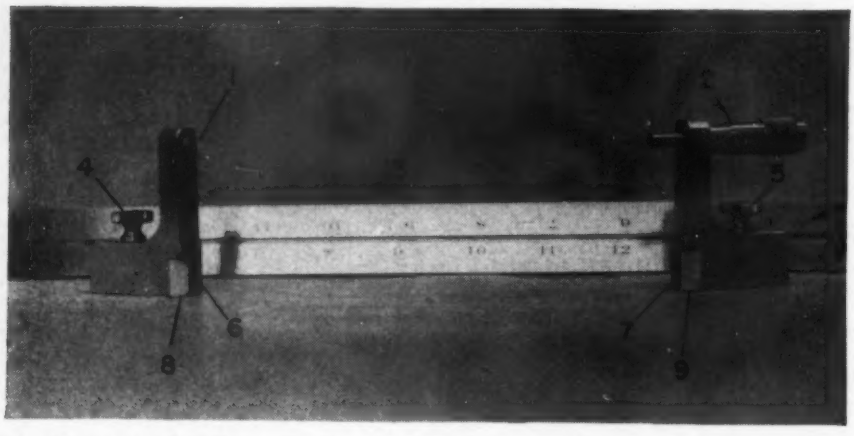
Releasing the pressure allows a spring (not shown) to retract the piston and gravity returns the slide to the original position where the bottom anvil is well clear of the work so the completed piece can be unloaded and a new one inserted.



Left: brass tube resting over forming blocks ready for squeeze; center: squeezing completed; top anvil pushes downward and its reaction lifts slide and brings bottom anvil in too; right: side view of press



Adjustable heads for the scale of a combination square make a micrometer caliper and comparator



Combination Small Tap and Die Holder Fits Lathe Tailstock

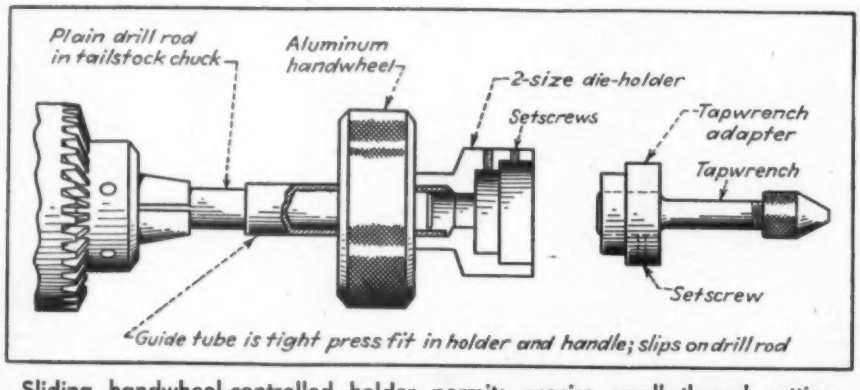
PETER RIGGIO

There is no good way of cutting small threads in a lathe with regular equipment because of the difficulty of getting the right feed and still hold the center in the right place.

This equipment consists of a ⅜-in. drill rod with a free-sliding tube fitted to it. Pressed on the tube are a step-socket to receive two or three frequently used die sizes and a large aluminum knurled handwheel.

With the drill rod chucked in the tailstock the die will feed itself onto the work as long as the handwheel is held. When the thread is completed, releasing the handwheel will stop the feed.

An adapter can also be made to fit a tapwrench into the die holder and thus double the tool's usefulness.



Sliding handwheel-controlled holder permits precise small thread cutting

Wide-range Adjustable Micrometer Comparator

D. E. McDONALD

Much micrometer work is comparing where absolute measurements aren't necessary. Here is an instrument which measures differences up to ½ in. by thousandths and can be set to any base dimension with the steel scale (3) used for the backbone to an accuracy of plus or minus 0.003 in. Jo blocks or standard length rods can be employed to establish any base dimension accurately.

The two sliding blocks (8 & 9) are identical and they have the conventional clampscrews (4 & 5) used by combination squares. The left block (8) has a fixed anvil (1) press-fitted in place. The right block (9) is equipped with a standard ½-in. micrometer head (2).

The instrument is set by clamping the heads on the scale with a 0.5000-in. Jo block between surfaces 6 & 7 and lapping the fixed anvil until the micrometer reads 0.000.

Rotary Bender Handles Cold-rolled Strip

W. C. ROEMER

The occasion for making one or many pieces from flat stock bent at a right angle presents itself so often that a simple fixture for this job is very useful. This fixture has been used for bending commercial cold-rolled steel (SAE 1015) ⅛ in. thick up to 1¼ in. wide. The bent parts are square, uniform, flat on both legs and free from twist. The effort on a 24-in. lever for bending ⅛-in. x 1¼-in. stock is only a comfortable one-arm pull which indicates that stock of a greater cross-section could be bent.

In its essentials, this fixture, Fig. 1, consists of a rotary bending member A, a stationary bending member B, and a clamping means C, all mounted on a base plate D. A block E, is attached to the base plate so that the fixture may be held in a vise.

The relationship between the rotary bending member A and the stationary bending member B is shown by Fig. 2. The stock clearances should be made as shown. Plates B for various thicknesses of stock can be provided in 1/32-in. increments. If clearance F is excessive a curva-

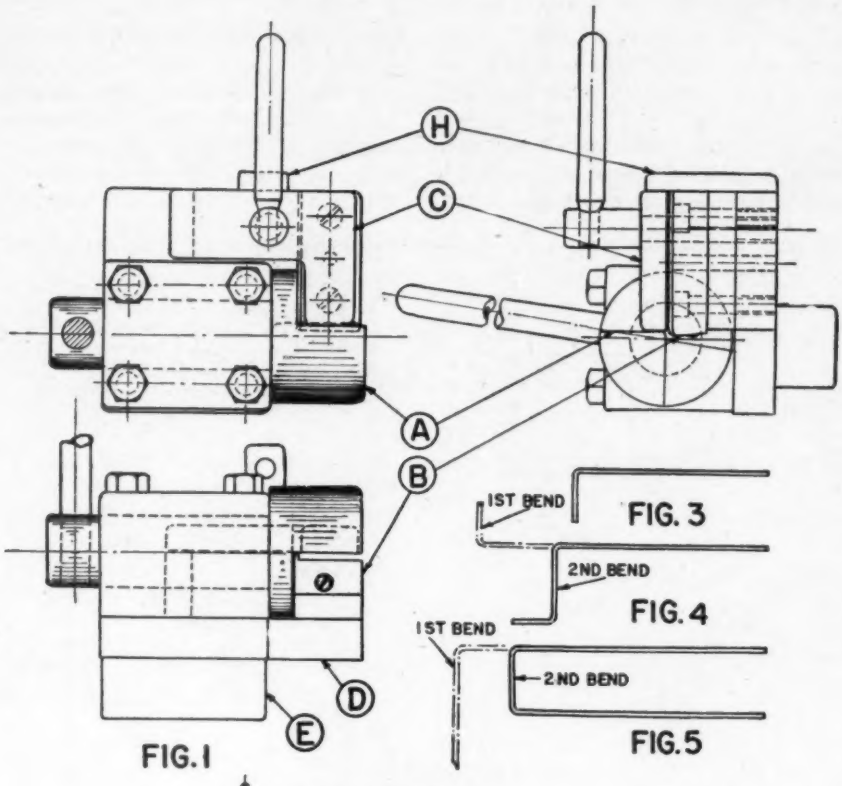


FIG. 1

FIG. 3

FIG. 4

FIG. 5

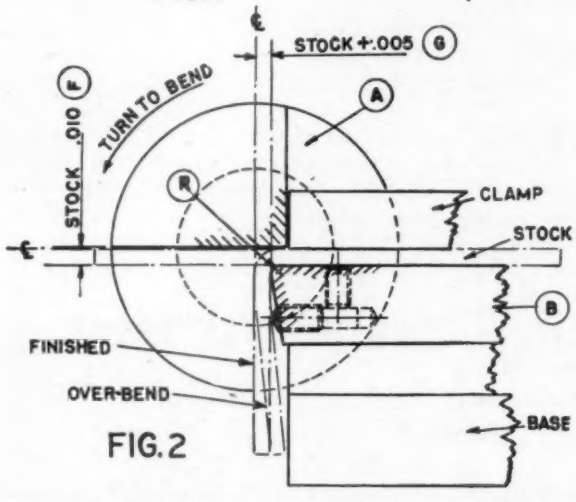


FIG. 2

Hand sheet metal bender takes stock up to 1¼ in. wide and ⅛ in. thick by inserting interchangeable plates to adjust the clearance

ture of the bent leg may result. If clearance G is excessive, the radius of the bend will be irregular. The minimum radius R is determined by the hardness of the stock so as to avoid a rupture on outside of bend. Note that a clearance and a stop screw is provided for overbending, the amount required being determined by the temper and recovery of the stock.

Fig. 3 shows a simple bend. Fig. 4 shows a common form made in two bends. Fig. 5 shows a yoke made in two bends. In order to bend a piece into this form it is necessary for the stationary bending member B to overhang to permit the first bend to fold under when making the second bend. Yokes are shown by Fig. 5 were successfully made on a fixture of this type from stock ⅛ in. thick by ⅞ in. wide.

For good results this fixture should be substantially made. For the stock sizes noted, the shank diameter of member A should be ½ in. and the head diameter 2½ in. The lever should be ⅝ in. diameter by 24 in. long. The lever should be inclined as shown so the rotary member A will stop against the clamp when fixture is empty. Under this condition, the piece H backs up the clamp to prevent bending the clamp screw. The dowel in piece B should be at least 5/16 in. diameter so this piece will not set back under the strain.

Redesigned Air Nozzles Solve Cleaning Problems

ROBERT A. SHAW

Machining and grinding complicated castings, like cylinder blocks introduces a chip-removing problem. Haphazard use of air blasts can not be only wasteful of air, but also slow, and worse, will often merely propel the waste metal deeper into the water-jackets and other cored passages.

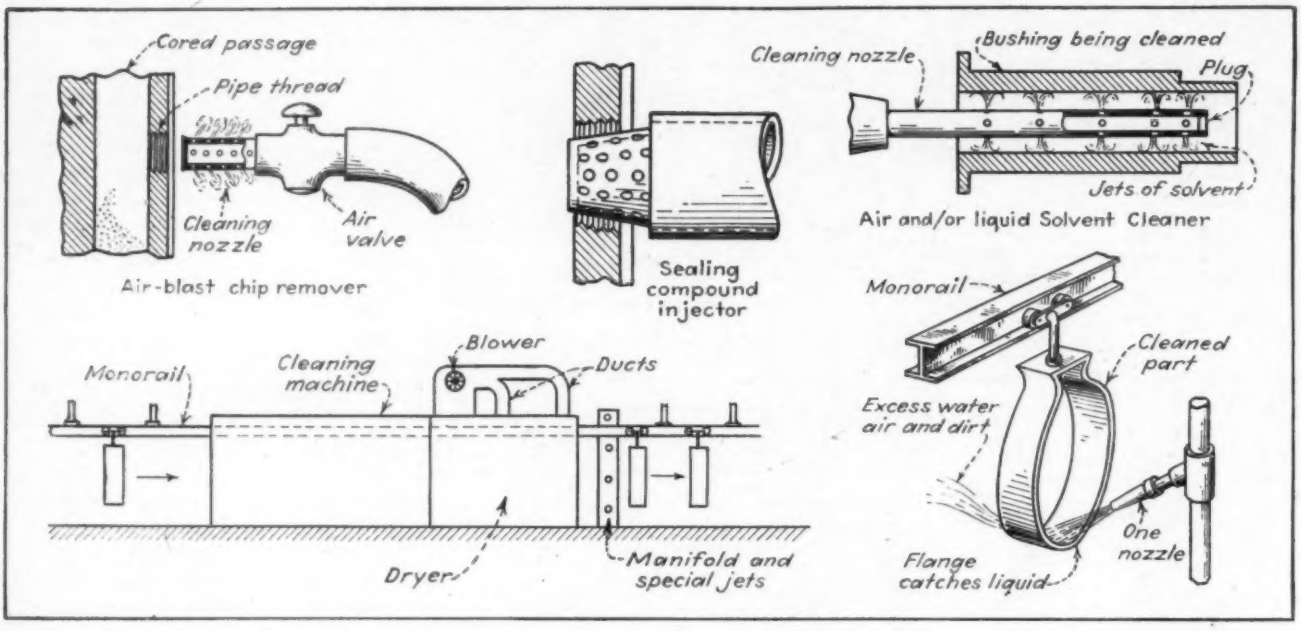
The first step in designing an effective air nozzle for this service is based on the assumption that chips are created near the exterior surface—in drilling and tapping water-cooling connections on a cylinder block for example. Therefore, if the jet can be directed *outward*, the chips will never go any deeper, and "get lost" inside, later to rust and contaminate the cooling system, or eventually to clog other parts of the system.

The successful nozzle adopted has a ring of radial holes, drilled at about a 45° angle with the central axis forming a backward fan. This is inserted in the water-jacket hole, the air valve opened letting air hit all parts of the hole at once, expelling the chips. No air enters the water-jacket beyond this point.

A similar nozzle was also built for injecting sealing compound into the threads for making up the connections in final assembly. The nozzle in this case was a taper-plug to conform to the pipe-tapped holes fairly closely. The idea is the same; the only differences are a closer fit and more holes to distribute the more viscous compound better.

Quick-cleaning of long holes, either with air alone or with solvent under pressure is accomplished with a nozzle designed for the specific job. If both ends of the hole are open so the waste material can be disposed of in two directions, the jet holes can aim toward each end from the center. If it is a blind hole, all the jets should be directed outward to gain maximum efficiency. For all holes, the nozzle should reach the entire length and have enough jets so the cleaning medium will strike the whole surface to be cleaned with its maximum velocity, and not lose its force striking all in one place, then to slide, or be pushed, out of the hole without its original scouring action.

Quicker drying after washing processes, together with reduced rusting was the result of an air-blast system designed to get at intricate places where liquids and loosened chips were likely to become trapped and settle. Monorail, suspension conveyors are usually used in the washing machines to secure more uniform and thorough cleansing, as well as subsequent draining. The draining is hastened with a general, over-all air blast which can be best supplied by centrifugal blowers. (Plenty of volume is much better than pressure or velocity here.) After the castings have passed this stage, the stubborn, remaining liquid can be gotten out with special, individual nozzles aimed at the troublesome places.



Multi-holed nozzles with plugged ends and holes aimed backward blow all chips out of taped holes in large cavities, top left. Changing the length of nozzle, the number and angle of the holes, makes solvent blasting of long bushings, and sealing of pipe threads efficient. Getting that last trace of trapped liquid out after a cleaning process is achieved with a manifold and a system of jets directed at the difficult places

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Fourteenth Selection—Charles Bily on Wedge Toolholder

How Design Affects Heat-Treatment—I

SUCCESSFUL HEAT-TREATING depends largely on the design of the part. Heat-treating, no less than design, is also important in determining the life expectancy of a tool or machine part. Both should therefore be carefully studied before the job leaves the drafting board.

Fundamentally, the engineer must design the part to perform its work with maximum efficiency and minimum expense. It is also important that he keep in mind the basic reasons for part failure by cracking or warpage either during fabrication, heat-treatment or service.

Fig. 1—Heat will not dissipate as fast from the central area of the die *A* as from the ends, causing strains upon quenching. By drilling holes as at *B*, the areas of mass are more evenly balanced

Heat-treated steel has a certain strength determined by analysis, quality of the material and the heat-treatment given it. When a steel is subjected to forces beyond its capacity, cracks will result.

There are two types of force which either alone or combined can cause failure: internal strains set up during fabrication or heat-treatment and external forces from service. Many parts are put into service with internal strains equal to a large percentage of their total strength. Therefore, very little external force is required to cause failure.

In heat-treatment, the period of greatest strain is while the steel is being quenched. Quenching strains are developed by the "temperature gradient," or the difference in cooling rates between various sections of a single piece. Careful design of the part will tend to reduce quenching strains.

Sectional balance is the keynote to reducing the temperature gradient. Small thin sections of steel will dissipate heat much more rapidly than heavy masses, because there is less heat per square inch of cooling surface. Therefore, if both heavy and light sections are incorporated in the same piece, heavy strains will be set up, Fig. 1-*A*. Modifications that will overcome difficulties are shown in Fig. 1-*B*.

Sharp or re-entrant angles should be avoided in designing parts that are to be heat-treated, because they serve as concentration centers for service stresses as well as quenching strains. Concentration of service stresses frequently parallels concentration of heat-treating strains, and is often caused and cured by the same combination of circumstances.

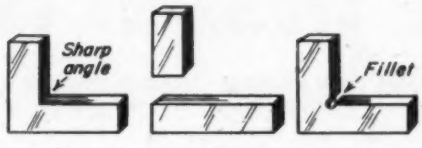


Fig. 2—Re-entrant angles as at *A* concentrate quenching strains. They are a source of warpage and soft spots, because it is almost impossible to keep gas bubbles from forming at them. Preferable method is to make assembly from two pieces as at *B*. A fillet as at *C* can be used, should be at least ⅛ in. radius, except for smallest work

For instance, where re-entrant angles are used in a design, Fig. 2-*A* it is almost impossible to keep gas bubbles from forming at the angle, which may cause a soft spot and possible warpage. This condition can be completely remedied in some cases by forming the angle from two pieces of steel, fastened together after heat-treating and grinding as shown in Fig. 2-*B*.

If it is not possible to design the part this way, the next best thing is to provide a generous fillet at the angle, Fig. 2-*C*. Another alternative, if these solutions are not suitable for a given part and application, is to make the piece from an air-hardening steel, which will require only still air as a quenching medium.

In many cases, it is impossible for the engineer to make his design without incorporating light and heavy sections of metal or sharp angles. Under these circumstances, he must consider carefully the choice of material from which the part is to be made. It should be kept in mind that the more drastic the quench, the more internal strains are likely to be set up, and, consequently, the greater the chance for cracking and warping. Water is the most drastic quench, oil is less drastic, and air is by far the least severe.

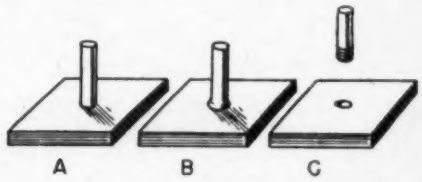


Fig. 3—A sharp angle between a heavy body and a thin section, as at *A*, is poor design, because heat is dissipated slowly from the heavier section. Some improvement can be secured as at *B* by using a smooth radius. Preferable construction as shown at *C*, when a thread or press fit can be used

Fig. 3-*A* illustrates a part having both heavy and light sections joined by a sharp angle. Figs. 3-*B* and 3-C show designs that are safer from a heat-treating standpoint. In all cases, an air-hardening steel should be used in order to guard against cracking in the shoulder.

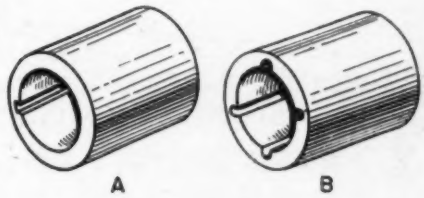
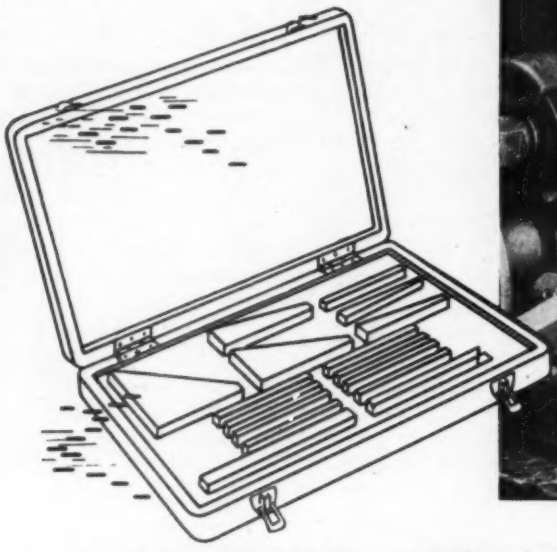
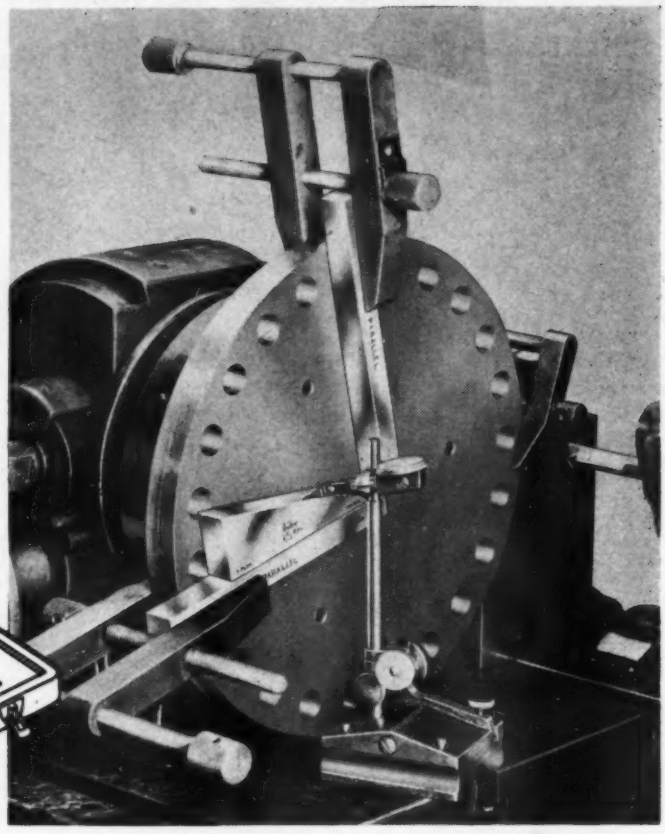


Fig. 4—Single internal keyways in sleeves, as at *A*, are bad from the heat-treater's point of view because there is chance of cracking and distortion. Equally spaced keyways with a rounded bottom, as at *B*, are much better construction

PROBLEM: To check spacing on holes bored 15° apart using common shop tools.

SOLUTION: Index holes; bore first hole, place parallel bar parallel to base; inspect with indicator Measure successive spacings by mounting 15° or 30° Webber angle gage blocks as illustrated. Indicate across top for accuracy.





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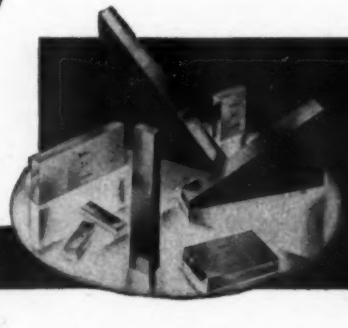

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How Design Affects Heat-Treatment—II

The sleeve with single keyway shown in Fig. 4, although very common, is a poor design from the heat-treater's point of view. In the first place, there is a good chance for cracking at the sharp corners at the bottom of the keyway, and the ring is almost certain to take an oval shape when quenched because of the unbalance in section. Fig. 4-*B* illustrates the corrections in design that should be taken. The corners of the keyway should be filleted to prevent cracks and the keyway should be cut opposite and at 90° to each other to balance the piece so that it will stay round when quenched.

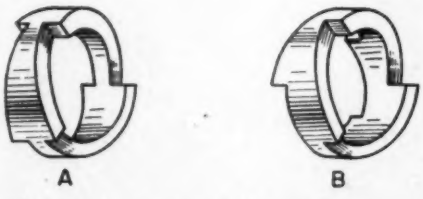

Fig. 5—A double-sided spot-facer or end mill is badly balanced for heat-treating if the upper and lower teeth are in line, as at *A*. Alternate the teeth as at *B* to achieve more even balance of mass

Improper design of a double-ended side-mill or spot-facer is shown at *A*, Fig. 5. Each side of this tool has three teeth with the teeth placed opposite to each other. This is a badly balanced condition in the cross-section of the piece and is made more serious by a sharp corner at the base of the teeth. A tool like this is almost certain to crack at the junction between the light and heavy sections. This condition may be corrected by staggering the teeth on opposite sides of the tool, Fig. 5-*B*, and introducing a generous fillet at the base of each tooth.

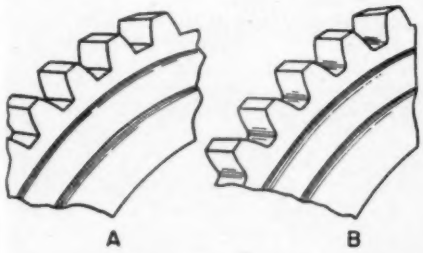

Fig. 6—Sharp corners at the root of gear teeth, *A*, are likely to cause cracks. Use a generous radius, as in *B*, to reduce damage

If no radius is provided at the base of gear teeth, as in Fig. 6-*A*, each angle will become a stress concentration point which is likely to cause cracks. The design would be made correct by leaving a generous fillet, as shown in Fig. 6-*B*.

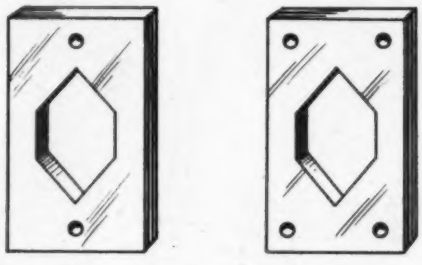

Fig. 7—Screw holes in direct line with the blank opening promote cracks. Offset such items as shown at *B*

Design of the blanking die in Fig. 7-*A* is poor. Setscrew holes, being in direct line with the sharp angles of the blanking section, are likely to cause a crack. This condition also reduces the "land" or area of greatest mass which makes the die unbalanced. Fig. 7-*B* shows a design that is much better metallurgically.

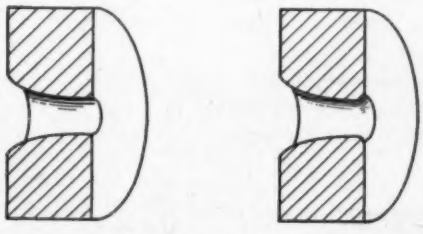

Fig. 8—Drawing or piercing dies should not have a sharp corner at the bottom of the opening, as at *A*. Spalling or flaking is avoided by a radius as at *B*

Fig. 8-*A* shows longitudinal sections of dies. Stresses and strains set up in heat-treatment and in service at the sharp corners of the small opening can easily cause spalling and flaking. This can be avoided by the use of a radius.

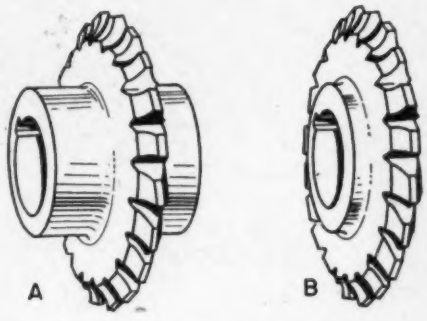

Fig. 9—A thick hub on a cutter, as at *A*, is likely to cause dishing at heat-treatment. Keep the hub and cutter body as near the same thickness as possible, as shown at *B*

When cutting tools are being designed, it is best to keep the hub and cutter body as near the same thickness as possible. The heavy mass in the hub will tend to warp and buckle, if not crack, the lighter cutting section.

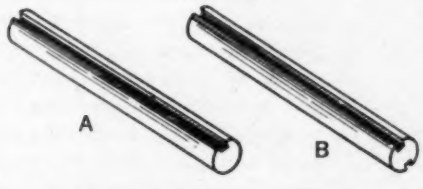

Fig. 10—Shafts with a single keyway, *A*, are likely to distort during quenching operations; use two opposite keyways or a spline shaft to avoid straightening troubles

Thousands of dollars are spent each year on the straightening of keywayed shafts. The shaft represented in Fig. 10-*A* will have a great tendency to warp when quenched, whereas the shaft shown at *B* will stay more nearly straight because of the balanced section.

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NEWS OF METALWORKING

Peak Peacetime Output of Farm Machinery Ahead Despite Strikes

CHICAGO—Despite the loss, by the farm equipment industry as a whole, of at least three months of output this year as a result of strikes, the industry wil hit a total volume of almost $700,000,000 in 1946, or slightly more than 1945.

The fact that the industry, despite innumerable handicaps, will set a peacetime production record in 1946 is the basis for predictions that, with all units operating, 1947 volume will exceed $1,000,000,000 to set an all time high mark. In the best wartime year, 1944, output was slightly more than $1,000,000,000.

Labor Uncertainties

The billion dollar estimate for next year is based on an end to the labor troubles that have plagued the farm implement makers and on an easing of the materials shortages. W. A. Roberts, vice president of Allis-Chalmers, says that output in 1947 could hit $1,250,000,000.

The labor difficulties of the industry since the war ended have affected every large producer except Massey-Harris and Minneapolis-Moline. Deere, Harvester and Oliver were strikebound for long periods. The J. I. Case Co. strike has been in progress all year, and still is not settled. The Allis-Chalmers strike, which started May 10, is in the process of gradual settlement.

Harvester Output Up

Harvester's output has climbed, since the strike ended, to a point where it is equal to the 1941 level, the best peacetime production rate ever attained by the company. Some Harvester officials, however, inject a pessimistic note regarding materials. They expect gray iron castings, sheet steel, copper, lead and paint to get tighter.

Oliver's production is as high as possible at present considering the amount of labor available. The company will have a good year, but the total will be about 30 per cent less than had been projected at the start of the year. Massey-Harris, with no important production delays, will set a peacetime record in 1946.

The plans of almost all units of the industry for expanded output next year make them logical customers for sizable machine tool and equipment sales. With Harvester in the lead, the manufacturers are seeking every possible aid to increase productive efficiency. Improved casting methods, faster and more automatic machining operations, and a growth in resistance welding are all forecast. There is also evidenced an increasing interest in better materials handling methods. Some plant engineers declare that more room for savings exist in improved materials handling than in any other single aspect of farm machine manufacture.

All-purpose Garden Tractor—Lodge & Shipley Machine Tool Co. is producing this "Choremaster" for all-purpose applications around the home or acre farm. This streamlined, lightweight tractor is easily controlled and weighs less than 100 lbs. Attachments include cultivating tools, lawn mower and a snow plow.

Demand Is Huge

While the backlog of the industry cannot be expressed accurately in dollars, the manufacturers say it is huge. They base their calculations on these points:

Farmers generally spend from 3 to 5 per cent of their income for machinery. With buying held down during the war, the total is expected to run to 5 or 6 per cent of total farm income for the next several years.

One out of each four machines now in use on farms needs replacement. As this demand is filled, other machines will wear out, and in the next few years almost a complete turnover is expected.

With parity guarantees, huge demands for food, the low level of farm debt, and the high level of farmer savings, the means for translating demand into sales exist.

New machines being introduced will create additional markets. The new tractor attachments that have been perfected, such as loaders and stackers, will sell widely, as will new devices such as cotton pickers, sugar beet and forage harvesters.

The "baby tractor" that is putting in an appearance will also help sales. Of the nation's 6,000,000 farms, only 2,000,000 are equipped with tractors. Formerly it was estimated that another 1,000,000 farms could be mechanized. This figure has been doubled by the new small tractor.

All Metal Civilian Plane Introduced by Buffalo Firm

BUFFALO, N. Y.—A 175-mile-an-hour airplane that looks like a midget P-51 fighter has been introduced here by the new Aero-Flight Aircraft Corporation.

The all metal plane is the brainchild of James Nagamatsu, who designed and built it with the help of his brother, Henry, head of aerodynamics research for the Cornell Aeronautical Laboratory, and some 20 other associates.

James Nagamatsu, president of the company, said that efforts are now being made to obtain a surplus Government-owned plant. He said he expects production to be underway by the first of the year.

Bubble Cabin

The plane has the same transparent cabin "bubble" canopy that was developed for military aircraft and has tricycle landing gear. It is a two-place, tandem-style model equipped with dual controls and two-way radio.

Mr. Nagamatsu said the aluminum craft's all metal construction will decrease maintenance and up-keep and simplify standardization for mass production.

Although its estimated speed, in excess of 175 miles an hour, will be exceptionally high for a plane powered only by an 85-horsepower motor, its builders claim a low landing speed of 45 to 50 miles an hour.

Gaging Business

A Lesson For Labor?

Despite the new parade of demands upon industry now started by the CIO auto workers and by John L. Lewis, most observers believe that union leaders will do their utmost to avoid another round of damaging strikes similar to the one which took place during the first half of 1946. Aside from the disruptions to industry and inconveniences to the public caused by the 1946 strike wave, it was a heavy blow at union treasuries and at the financial condition of individual union members, themselves. More than that, unions fear that the next congress may again try to pass some legislative restrictions upon labor organizations.

As it is, industry will probably resist granting further large wage increases at this time, especially since consumers have indicated an unwillingness to pay current high prices on many products. Management would like to reduce prices to help assure continued peak sales, but higher wages would not only make this impossible but would force prices higher. Industry's interest in keeping prices down is expected to result in few large price increases on durable goods as OPA controls are removed.

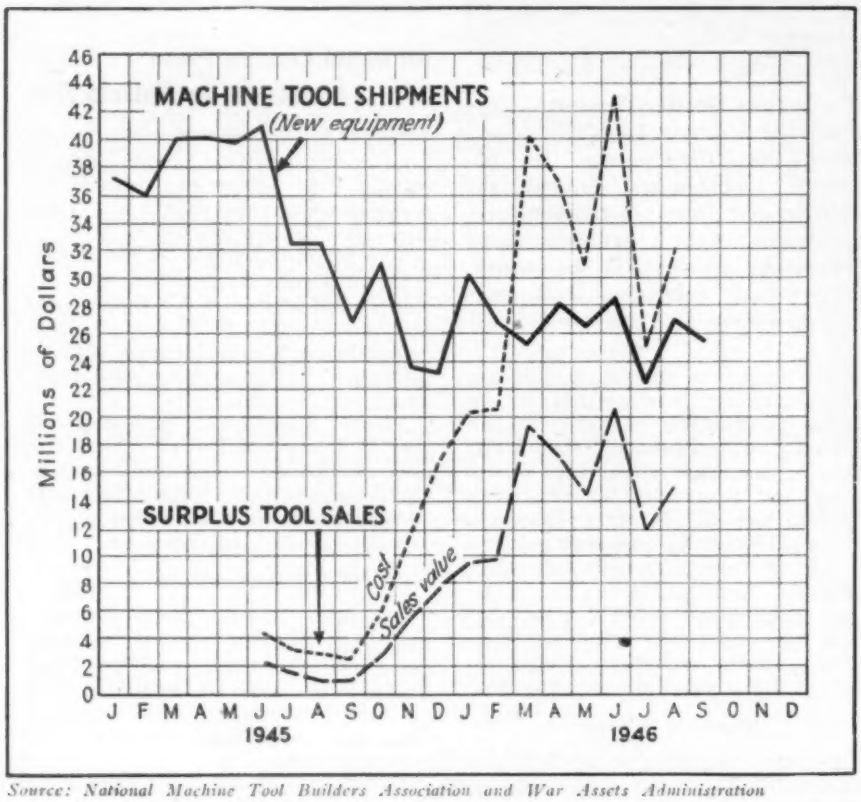
Right now, some prices have started to come down and others are wavering. If the cost of living should start to go down, it would probably have an interesting effect on pending labor demands.

Automobiles and Steel

The complaint of various automobile companies that sheet steel shortages were forcing them to shut down plants and curtail operations has been countered by a statement by the steel industry that the auto industry has been getting more of a share of total steel shipments than it did prewar. Actually, sheet steel is not the only factor affecting auto production schedules. The auto industry is also beset by inadequate supplies of lead, radiators, electrical equipment and parts, and copper wire, and the relative damage caused upon production schedules by these shortages have shifted from time to time. Thus, if more sheet steel were available, it is doubtful that the industry could utilize it, due to the other shortages itemized.

Actually, the auto industry is not doing too badly. Right now, truck output is at record monthly levels, and the output of replacement parts exceeds prewar peaks. The major lag in output has been in passenger cars and the heavy tonnage of materials pouring into auto plants is not adequate right now to permit record output here, too.

As for sheet steel output, this is due for a further rise in three or four months as new rolling mill crews are trained to handle wide sheet over 76 inches on mills that have been handling ship plate and other heavy stock during the war. One steel company reports that in a few months it will be able to get twice the tonnage it does today from its wide strip mill.



Source: National Machine Tool Builders Association and War Assets Administration

Equipment Sales Lagging—Sales of both new and surplus equipment have fallen off over recent months. Machine tool business of War Assets Administration has probably dropped quite sharply, since the agency has issued no official figures for July and August. American Machinist estimates that WAA sales at reduced prices fell from $20,502,000 in June to $12,000,000 in July, and recovered slightly to $15,000,000 in August. Shipments of new machine tools for September at $25,468,000 were slightly below the August total of $26,911,000. Orders for new tools placed in September dropped about 10%

Tool Orders Lag

The doldrums which hit the machine tool industry in August have continued since, and the War Assets Administration's new drive to sell $350,000,000 worth of surplus tools at bargain prices is likely to continue to depress the new equipment market. This gloomy outlook is backed up by the fact that sales of surplus equipment have also been slumping.

The WAA has announced a four-month drive to liquidate this large volume of equipment, and since recent sales of new equipment have averaged around $25,000,000 monthly, business is expected to be depressed until early 1947.

Seven-Month Backlog

Fortunately, the machine tool industry still has a seven-month backlog. Unfilled orders at the end of September totaled $179,796,543, of which 29.7% represented foreign orders. September shipments amounted to $25,468,000, as against $26,911,000 for August. However, cancellations in September at $3,048,038 were down from August's $4,461,032.

September orders were at lowest level since February, 1946. The September business of $23,088,369 was below the August total of $26,291,300. October business has run close to the September level.

Makers of mechanical and hydraulic presses continue to have huge backlogs. New orders still are equal to or exceed new production.

Machine Tool Industry Condemns New WAA Reduced Price Program

CLEVELAND—Machine tool builders and dealers were generally critical of the War Assets Administration's move to sell $350,000,000 in surplus machine tools at prices averaging 25% of original cost value, under its "fixed price" program. Contacts with dealers and builders in other cities revealed similar protests rising around the country.

Major reasons for criticisms were: (1) the expectation that this price-cutting step by WAA would cause surplus buyers to wait around for a further weakening in prices; (2) many of the items listed by WAA as available under the new policy were items in great demand, such as drill presses and special milling machines, for which there was no reason to cut prices in half; (3) dealers handling surplus equipment could see no reason why they should sell items at around $500 for a 12½% commission, when the headaches involved were far greater than the work necessary to sell new machines at a cash commission five times as great per sale. Some dealers expected that the policy would attract speculators who would buy the equipment for the motors and other parts, which would easily cover their purchase price, thus defeating WAA's alleged objective of speeding this equipment into the hands of industries needing it, or into the hands of rebuilders.

Equipment Market Hit

The industry generally expects the new four-month bargain sale of WAA to hurt the new equipment market for an indefinite period of time. What many wondered was what WAA would do with the machines if they were unsold at the end of the four-month period.

Industry members ridiculed WAA's intent that buyers of surplus equipment would only have to pay scrap prices for tooling attachments, if they indicated that they had no use for tooling which came with the machines and would scrap it. The industry was also amused at WAA's intent to sell units made in 1921 or earlier on a bid basis. Since there have been many cases of favoritism in the past (some of which are now under investigation), the handling of bids might result in sales as "scrap" to favored buyers.

N. Y. Dealers Also Critical

NEW YORK—Machine tool dealers here generally felt that WAA's price-cutting action was rather ill-timed. Many were not surprised at this step by the surplus officials, since the poor handling of surplus tool sales had begun to alienate too many buyers. One dealer reported attending a recent site sale here, where he was just about the only one interested in machine tools. But he said that many good units he saw were not listed among the offerings.

General opinion is that surplus machine tool sales in recent months have lagged, partly due to the general drop in equipment business, but also the result of inadequate listing of good available units and the fact that the most salable units have already been purchased.

Many dealers have decided to stop handling surplus units offered under the fixed price policy, except in cases when specifically requested by regular customers.

Application of Fixed Prices

WASHINGTON—The War Assets Administration's sale of machine tools under fixed prices, effective October 28, covers both new and used general purpose equipment. A maximum depreciation of one month's active use is authorized on new machines. The $350,000,000 worth of surplus equipment to be sold is said to represent 60% of present surplus machine tools.

The new fixed prices, under revised Regulation 13, will also apply to sales by Army, Navy, Maritime, and RFC to contractors in possession of tools on lease from the government. Prices will be 5% lower (same as under the Clayton formula differential), because the machines are in place and no transportation and handling costs are involved.

Materials Handling Show To be Held Jan. 14-17

NEW YORK—The first materials handling exposition will be held at the Public Auditorium, Cleveland, January 14-17, 1947, according to Earl I. Burke, manager of shipping, Republic Steel Co., and chairman of the policy committee of the exposition. Discussions of materials handling problems by experts will be held concurrently with the Exposition.

Surplus Plant Disposal Task May Be Withdrawn From WAA's Authority

WASHINGTON—A line of thinking is developing on Capitol Hill that war plant disposal should be taken away from War Assets Administration, giving it to a governmental agency especially created for the job and perhaps called a "Government Facilities Administration."

The idea is expected to come into the open coincident with hearings scheduled to begin Dec. 10 before the Senate (Murray) Small Business Committee on examining and possibly exposing the failings of plant disposal.

Guinea pig for the hearings will be the government's light metals plants, the outstanding case to date in which broad economic objectives have dictated disposal policy. The committee will publicize the way two new competitors—Kaiser and Reynolds—have been built up alongside Alcoa.

The committee is then expected to concentrate on government steel, chemicals, petroleum, electrical machinery, electronic and machine tool facilities. These subjects might well lead to concrete action for a separate plant disposal agency as the committee feels WAA personnel thinks mostly in terms of commodities rather than plants.

The prospective agency would likely be charged with the broader question of national adequacy of production facilities in various industries in which government has a plant stake. It might lay the groundwork for setting up rival operators to the "big" companies.

Completing Unfinished Plants

In this phase of GFA's operations would arise the issue, currently ignored by WAA, of completing some government plants unfinished at the war's end. They would then be offered for sale as groups of integrated industrial production units. For example, Murray's committee is already looking into a proposal to install docking facilities at Kaiser's Baton Rouge alumina plant. The same problem applies even more forcibly in the government's substantial but scattered steel-making plants.

The Senate Small Business Committee doesn't make laws, but, guided by its staff chief, Dewey Anderson, its hearing gan influence legislation.

Sheet Steel Shortage to End by 1947 Second Quarter; Prices Uncertain

PITTSBURGH—Barring strikes, the supply of sheet steel is expected to be in rough balance with demand by the second quarter of 1947. Since sheets are the tightest steel item at present, the outlook for sheets as expressed by well-informed industry observers here means that shortages in other types of steel are expected to be ended during the first quarter of 1947.

The growing feeling here that a more orderly steel market is imminent stems from the current high level of manufacturers' inventories and the rising buyer resistance to price for consumers' durable goods.

Price Situation Unsettled

However, pending price decontrols have unsettled the industry's entire price outlook. Steel managements do not wish a general price increase at this time, unless, of course, raw material prices go up too sharply. The major reason for this is the pending wage negotiations with the CIO steel workers, which already may be complicated by the favorable second and third quarter profits of steel companies. Of course, the industry wanted price ceilings lifted for certain unprofitable products, so that consumers of them could get a fairer share of the total steel output.

Price decontrol is a worry to the steel industry, too, with respect to what may happen to scrap and other key raw materials.

This is why the opening of steel mill books for 1947 business has been delayed. Consumers have been told that there is no use in their trying to anticipate a price rise by ordering more, since they would only continue to receive their usual quotas from the mills. In effect, this has eliminated price hedging as a factor in the pressure exerted by consumers.

In sheets, the tightest item of supply, a substantial amount of new capacity will be in by the end of the first quarter of 1947 and help to ease the situation. The industry has openly stated that 2,000,000 tons of new sheet capacity would be available by mid-1947, but few people seemed to realize that some of this would be completed before that date.

Peak Steel Shipments

Meanwhile, finished steel shipments have been at the best level on record. In actual tonnage, they are less than during the war period, but war shipments included large monthly output of semi-finished steel. This factor in shipments has now been reduced. At the same time, reduced output of plate has contributed to reduction in total tonnage of shipments, since sheets and strip take longer to roll. However, there are more "tailor-made" steel items pouring forth today.

Army-Navy Drawing Practice Standards Near Completion; Large Savings Seen

WASHINGTON—Four sections of the work of the Joint Army-Navy Committee on Standard Drawing Practices are nearing completion, and individual standards will be issued at an undetermined date for compliance of the Services and manufacturers in specifications for production of arms and equipment.

These four sections, in charge of task committees are: (1) abbreviations, (2) welding symbols, (3) drawing sizes, and (4) screw threads. In all there are now 24 drawing practice tasks on the agenda, for some of which committees have not yet been appointed.

The Committee on Standard Drawing Practices was set up late in 1944 as a result of a joint memorandum from Secretaries of War and Navy to the Army-Navy Joint Specifications Board, which functions under the Army-Navy Munitions Board.

The Specifications Board is chairmaned by an Army and a Navy official, acting for six months each alternately.

Near the war's end several large manufacturers told Army and Navy that differences in drafting practices and specifications had cost long delays and huge waste of manpower and money, and that such differences might be more serious in any future war. ASA took an important part in formation of the present drawing program, but has since dropped out of the picture, apparently because coordination of both industry and military drawing standards at the same time was too complicated.

The 24 task committees of the Drawing Practices Committee are as follows:

General drawing practices: projection, sections and sectioning, scales, lettering and line conventions.

Drawing sizes: committee has reduced total sizes from about 55 to 11; most of the new sizes are in multiples of 8½" x 11" letter size. A few special sizes are set up for aircraft and other products.

Format for production drawings.

Format for construction drawings.

Drawing titles: involving standardization of nomenclature. No committee formed as yet.

Drawing numbers and parts numbers: probably will involve gearing to International Business Machines, which have adequate digit capacity, but most manufacturers want to limit numbers to 10 places, saving space for other designations. Some manufacturers are running out of numbers, due to war production. No committee.

Types and Dimensions

Types of drawings: such as architectural, production, structural, electronic, mechanical, heating and ventilating, airframe, etc.

Dimensioning and tolerancing: to assist in clarification of complex systems of "dimensioning" and "tolerancing" now in use by the services.

Screw threads.

Surface roughness: standards will be thoroughly coordinated with industry.

Materials: due to extent of data that will go into this section, further study is necessary before scope of the standard can be set up.

Abbreviations: thousands of them will be reduced to an adequate number to cover field.

Definitions: no committee.

Architectural symbols: no committee.

Electrical-electronic symbols: several hundred involved.

Mathematical symbols: no committee.

Mechanical symbols.

Structural symbols: no committee.

Welding symbols: will be thoroughly coordinated with American Welding Society and there will be no technical differences between the two.

Welding nomenclature and definitions: no committee.

Welding charts: no committee.

Standard welding joints: no committee.

Non-destructive test symbols: no committee.

Revising drawings: no committee.

Truck Bookings Down

CHICAGO—Domestic bookings for electric industrial trucks and tractors during August, 1946, totaled 339 units, according to the Electric Industrial Truck Association. Net value of chasses booked during August totaled $1,457,448, down slightly from July's $1,529,466.

Detroit Letter

Tooling Below Normal

Plans to keep changes to a minimum on the 1947 model cars which will begin to appear after the first of the year are borne out in activity rates in the tooling shops of the Detroit area. They are operating in definitely low ground, well below normal, and, of course, far under wartime levels. It might be noted in this regard that recent incorporations of tool and die shops in Michigan, having been maintained at a high rate since the start of the year, are now falling sharply off at Lansing.

Generally speaking, the small shops are operating fairly close to standard 40-hour work-weeks. In the larger shops, where customer relationships are correspondingly more stable, some overtime is being put in, but a citywide average would probably show less than a full 6-day, 48-hour week even in these busier establishments.

Jigs and fixtures can be had in an average of about 4½ weeks, small tooling in this classification often being available in half that time. Sheet metal die delivery promises are ranging below a month for the most part, although forging dies require five weeks or more. Even fussy lamination dies can be obtained much more quickly than has been the case for many years.

Gages continue to be available almost on prompt basis. This condition has prevailed for the past few years in Detroit, being one reflection of the large number of gage shops which sprang up in the early war period when requirements for measuring equipment far outstripped productive facilities. Larger specialty gages of various sorts, however, are not available at all on any such quick-term basis. One difficulty here appears to be a scarcity of really competent gagemakers.

Ford Operating Changes

Expectations that gage block manufacture will continue to be in demand are indicated in plans of Ford Motor Co. to move its Johansson gage division into a new 2-story annex at the Ford plant at Waterford, Mich. About 6,500 sq. ft. of additional space will be afforded the division in its new village industry location; and plans call for a broader sales program to increase the use of Jo-blocks in factory operations. Of note is one statistic Ford has released—as many as 13,000 precision gage blocks have been made in a single month.

Several of Ford's village industry plants in the Dearborn area, of which Waterford is one, are on the sales block, in line with company policy of disposing of many operations not related to actual production and sale of cars and trucks. The Saline plant, where soybean processing was carried on, was recently sold to Soybrands, Inc. The Willow Run hydro plant was sold some time ago. Plants at Sharon Mills, Cherry Hill, Clarkston, Hayden Mills and Dexter have been closed and are up for sale.

Ford continues to make news in other ways. It made another spectacular addition to its enlarging executive staff late in October when Del S. Harder joined the company as vice president, operations.

Harder made his automotive reputation as general factory manager of the fabricating division of Fisher Body Division. In moving to Ford from Fisher he took the same course as did Lewis C. Crusoe, former Fisher purchasing director and present head of Ford's newly created planning and control division.

Numerous former G. M. people are bobbing up at Ford in top positions. This is particularly true in the engineering department, which is becoming heavily staffed with technicians formerly associated with General Motors divisions, headed, of course, by H. T. Youngren, former chief engineer at Oldsmobile and now Ford director of engineering. The trend is probably a compliment to G.M., for Ford avowedly wants the best people.

Competitive Market Looming?

Auto company production worries are being amplified by renewed consideration of the problems created by higher prices. No less an analyst than D. U. Bathrick, sales manager of Pontiac, told dealers recently that a competitive market in which "automobiles must again be sold and not doled out like prizes" may be at hand by next summer. This view is not generally shared, but weight must be lent Bathrick's viewpoint that within the next twelve months or so rising prices may have reduced new car purchasers most considerably while increased production may have satisfied the extreme emergency market.

Bathrick made these observations at Kansas City, where a new General Motors plant to assemble Buick, Olds, and Pontiac cars inaugurated production. This plant appears to be the only new one in the B-O-P combination which is getting into production anywhere near projected time. The Wilmington assembly plant is no longer scheduled to build cars until fall of 1947, due to steel and other shortages. At Framingham, Mass., production is also not programmed before next fall, for the same reason, even though construction is now going ahead. This G. M. tendency to hold much of its intended expansion in suspension also includes the deletion of the Chevrolet-Fisher plant for light car output, well publicized a month earlier; the less publicized holdoff on the new G. M. research center; and other jobs.

Petite French Auto—Among the small French autos shown at the Paris Motor Show which opened early in October, was this unusual car. Designed and built by Jean-Pierre Wimille, European racing ace, featuring a plastic windshield and the driver's seat in the center with a passenger seat on either side and slightly to the rear

CAP Approves $2 Billions in Industrial Construction; $1.4 Billion Rejected

WASHINGTON—Despite materials shortage, and preferences for veterans' housing, Civilian Production Administration has authorized the biggest peacetime industrial construction boom in history.

March 26 to September 26 CPA approved about 52,000 applications for industry building, estimated to cost just under $2 billion. The boom would have been half again as big had CPA not rejected 3600 other applications worth $1.4 billion.

Over 50 plant projects, listed herewith, constitute an enormous market for machine tools, other equipment, and manufacturers' supplies. In most items total cost is broken down into building and equipment cost estimates. These data were complied for *American Machinist* by its Washington staff and CPA's information division. CPA officials do not know progress status of the authorized construction jobs, but they believe that since an application involves considerable company cost and effort, most were made with firm intentions and will be completed.

Projects are being approved at the rate of 35 or 40 per week, and no application let-up is in sight. Lowering of the ceiling in May from $48 million per week to $35 million reduced applications, because it fenced out some big operators, but it indicates no slackening of construction planning.

Approvals Mountings

Facilities Review Committee, which passes on appeals, mostly big stuff, shows 610 applications approved, valued at $403 million, and 4735 rejected, which would have cost $384 million. CPA limits industrial construction under Order VHP-1 (Veterans Housing Program, Order 1), instituted last March 26.

But the limitation allows industrial construction to use most materials in adequate supply, and local authority passes on applications, in accordance with local housing need, materials and labor supply. John D. Small, CPA Administrator, says he expects more than two-thirds of construction in the coming 12 months will be non-housing, which includes schools, hospitals, and the like, in addition to plants.

CPA, sated as it is with astronomical figures, is amazed at the size of the non-housing push, nonetheless because it is coincidental with War Assets Administration disposition of surplus plants by sale and lease. Of the $16 billion in war facilities authorized in 1940-44, about $4 billion was in plants judged to have peacetime serviceability. But more than half of the war plants cost over $25 million apiece, and many have proved not practical for peace industry, except under multiple-occupancy plans, which WAA is pushing now. Many plants even of the right size, are in the wrong places; conversion of many from war purpose to peace use is not feasible; prospective purchasers and renters often find the government's figures higher than expected earnings will justify.

Major Projects Listed

The list is arranged roughly in the order of approvals.

Potomac Edison Co., Hagerstown, Md., power plant at Williamsport, Md.; addition to existing buildings; $800,000 cost of structure; $3,200,000 equipment cost; cost $4,000,000.

Link-Belt Speeder Corp., Cedar Rapids, Ia., cost of project: structures $850,000; equipment $550,000; cost $1,400,000, to build excavating, material-handling and erection cranes, and shovels, which are extremely critical.

National Gypsum, Buffalo, N. Y., lime and steel processing plant at Kerns, Va., consisting of integrated series of buildings; structures $820,000; equipment $1,672,000; cost $2,492,000.

General Motors, Saginaw, Mich., 400 by 500 foot building; structure $3,092,568; equipment $4,900,000.

Rust Engineering and Celotex Corp., Jefferson Parish, La., new steel building to house machinery and equipment to increase production 25 to 50%; structure $1,487,000; equipment $2,820,000; total cost $4,300,000.

Pittsburgh Corning Corp., Pittsburgh, Pa., new facilities for manufacture of structural glass blocks; structure $475,000; equipment $500,000; cost $975,000.

Saginaw Malleable Iron, Division of General Motors, Saginaw, Mich., manufacture of castings essential to reconversion; facilities for production of malleable and gray iron castings; structure $1,621,000; equipment $4,000,000; cost $5,621,000.

Crucible Foundry Co. of America, Midland, Pa., carbon and alloy bars plant; cost $3,523,000.

Libby Owens Ford Glass Co. Plaskon Div., Adams Township, Toledo, Ohio, resin plant, boiler house and moulding plant; structure $2,140,000; equipment $2,122,000.

Bethlehem Pacific Coast Steel Corp., Vernon, Calif., major additions to open hearth hot bed furnaces; structure $2,492,000; equipment $5,970,000.

B. F. Goodrich, Marietta, Ohio, facilities for production of plastics, factory, office, and film building; structure $908,000; equipment $1,157,000.

B. F. Goodrich, Breckville, Ohio, research lab., structure $2,200,000; equipment $225,000.

Scranton Electric Co., Scranton, Pa., extension of existing power house; building $798,000; equipment $3,300,000.

Virginia Power & Electric Co., Richmond, Va., extension of power plant; building $750,000; equipment $2,093,000.

Ford Motor, Hopeville, Ga., plant for assembly of Ford and Mercury cars; structure $1,600,000; equipment $1,700,000.

Illinois Bell Telephone Co., Chicago, structure $2,700,000; equipment $5,800,000.

E. I. duPont, Washington County, W. Va., plastic plant—15 buildings, structure $1,700,000; equipment $2,600,000.

Continental Can Co., Utica, N. Y., factory and offices, structure $974,000; equipment $800,000.

Duke Power Co., Charlotte, N. C., 65,000 k.w. power plant; structure $774,000; equipment $3,948,000.

Jones and Laughlin, Aliquippa Works, Aliquippa, Pa., new building and alteration of others for steel production; structures $1,897,000; equipment $7,803,000.

Chrysler Corp., Fort Detroit Mich. adhesives plant; structure $869,550; equipment $525,000.

Pennsylvania Power & Light Co., Monroe Township, Pa., 150,000 k.w. power plant to meet electrical service requirements in area (28 towns); building $7,194,000; equipment $15,329,000.

General Motors Corp., Electro-Motive Div., McCook, Ill., building to house engineering department, research and development operations, metallurgical and chemical laboratory, for production of Diesel locomotives; building $971,539; equipment $129,000.

Allis-Chalmers Co., LaPorte, Ind., plant to increase production of combines and corn pickers; agricultural equipment $1,645,000.

Carnegie-Illinois Steel Corp., Gary, Ind., plant to increase steel and tin plate production; 45 new buildings, and alterations to existing buildings; buildings $2,800,000; equipment $35,785,000.

Consolidated Gas Electric Light & Power Co., Baltimore, addition to existing power plant; building $2,000,000; equipment $5,200,000.

Carnegie Illinois Steel Corp., Dravosburg, Pa., sheet steel plant, including extension of several buildings and additions to others; building $2,361,900; total cost $15,000,000.

Aluminum Co. of America, Pleasant Valley, Ia., aluminum sheet and plate plant; building $11,757,000; equipment $23,088,000.

Perfection Stove Co., Cleveland Ohio plant for the manufacture of steel furnaces and unit heaters $1,923,198.

Johns Manville Products, Marrero, La., building for the manufacture of transite pipe; building $850,000; equipment $1,149,000.

Dow Chemical Co., Midland, Mich., plant to produce plastic known as Saran Polymer; plant $420,000; equipment $1,520,000.

Consumers Power Co., Essexville, Mich., and Muskegon, Mich., additions to steam-electric power plants; Essexville building $1,000,000; equipment $3,000,000; and Muskegon building $2,500,000; equipment $7,000,000.

General Motors, Chevrolet Light Car Div., Cleveland, O., building $15,250,000; equipment $47,305,670.

Carnegie Illinois Steel Corp., Dravosburg, Pa., expansion of sheet steel plant to produce in qualities and quantities to meet increased demands, $2,361,900.

Perfection Stove Co., Cleveland, O., steel furnaces and unit heaters plant; $1,923,198.

Public Service Gas & Electric Co., Woodbridge, N. J., power plant; $1,750,000.

St. Jospeph Lead Co., Josephtown, Pa., expansion slab zinc plant; commitments made for $2,390,000.

Independent Pneumatic Tool Co., Chicago, Ill., small motors factory; $600,000.

General Electric Co., San Jose, Calif., motor plant; $1,700,000.

Buick Motors Div. (General Motors), Flint, Mich., renovation vacant building; $594,495.

Sheffield Steel Corp., Kansas City, Mo., mill; $1,500,000.

United Air Lines, San Francisco, Calif., repair base, $1,700,000.

Bethlehem Steel Co., Sparrows Point, Md., building for production of tin plate; $1,413,126.

Central Illinois Light Co., Peoria, Ill., power plant expansion; $1,070,000.

Aluminum Co. of America, Hillside, Ill., casting plant; $1,779,600.

Bethlehem Steel Co., Phila., Pa., plant; $711,700.

Long Island Light Co., Port Jefferson, N. Y., electric generating plant; $3,875,000.

Civil Aeronautics Administration, Washington, D. C., blanket authorization for installation of blind flying equipment at various airports; $772,000.

Bakelite Corp., Ottawa, Ill., Vinylite factory; $1,950,000.

E. I. duPont de Nemours, Deepwater, N. J., detergent plant; $556,800

Western Electric Co., Baltimore, Md., wire and cable plant; $3,208,000.

Calumet & Hecla, Decatur, Ala., copper plant; $4,165,000.

General Electric Co., Pittsfield, Mass., plastic powders facilities; $1,466,000.

City Light & Power Plant, Frankfort, Ind., boiler house addition; $672,000.

Grand City Containers, North Bergen, N. J., factory; $1,350,000.

Anaconda Copper Mining Co., Anaconda, Mont., phosphoric acid plant; $1,069,598.

Washington Bulletin

WAA Personnel Troubled

War Assets Administration is paying for its aggressive surplus disposal policy in loss of personnel, and in low morale of those who stay. Every time Administrator Littlejohn tells Congress he will wind up a certain program in a given time, his best employees decide it is time to look for another job. The more goods he moves, the more turnover and confusion he has to put up with.

Littlejohn has acted fast and tough on abuses in electronics. He has established stringent regulations to be followed by administrators on priorities, equitable distribution, and discounts. His newest headache is talk in Washington of removing surplus plants from his jurisdiction.

WAA's new drive to unload $271,000,000 worth of automotive parts will not help owners of old passenger cars much because most of the surplus is for commercial trucks. Army bought only about 60,000 automobiles during the war, and its stock of parts was small. WAA's truck parts shelves have been well rummaged, but many useful items remain. Agency officials are anxious to sell the material fast because they figure manufacturers of new trucks, now producing more than before the war, will take time to make parts, which bring them more profit than assembled units. Small distributors and fleet owners, as well as big dealers and manufacturers, will get a crack at WAA's parts sales.

Steel Supply Distribution

Distribution of the short steel supply in the Fourth Quarter is a ticklish task, and John D. Small, CPA Administrator, is calling for an informal panel of experts to help him. Particularly, he wants to keep steel flowing to warehouses for small business, aims to jack up freight car production, and pull the distribution kinks out of pig iron, sheet steel, iron and steel scrap, and coke.

One steel industry advisory committee member said many steel requests are far in excess of needs. When the man tried to prove his point by showing that 12 tons of steel each for the freight cars planned was far less than requested, CPA said the wheels and axles had not been figured in. Nevertheless, Small told steel executives they could help by withholding shipments from customers who obviously can get along without it.

Preference programs, he said, will require only about 9% of total 14,500,000 Fourth Quarter production, but the percentage of some critical shapes is much higher than that. The Administrator stated that complaints are from big and little companies alike, indicating that his distribution is on an equitable basis.

Incentive for Pre-Fab Homes

The Government is tackling profit control, sweetened somewhat with a bonus incentive for mass-production economics, onto its contracts underwriting market guarantees for prefabricated housing under the Veterans Emergency Housing Act.

First such deal with a pre-fab producer has been negotiated by Housing Expediter Wyatt with HomeOlo Corp. of Chicago. It calls for Government guarantee of a market for 19,400 homes to be turned out by the end of 1947—beginning at a 10-a-day rate which HomeOla has been doing on its own and running up to 30-a-day in January, 40-a-day in February, to 100-a-day by June.

In exchange for the Government market guarantee, HomeOla agreed to a specified dollar profit (before taxes) on each unit it sells. The company is to get one-third of the savings in cost brought about by increased production rates. However, in computing production savings, no allowance is made for increased material and wage costs; higher prices will be allowed only if increased material and labor costs more than eat up assembly-line savings. The other two-thirds of cost reductions must be passed along in reduced prices to customers.

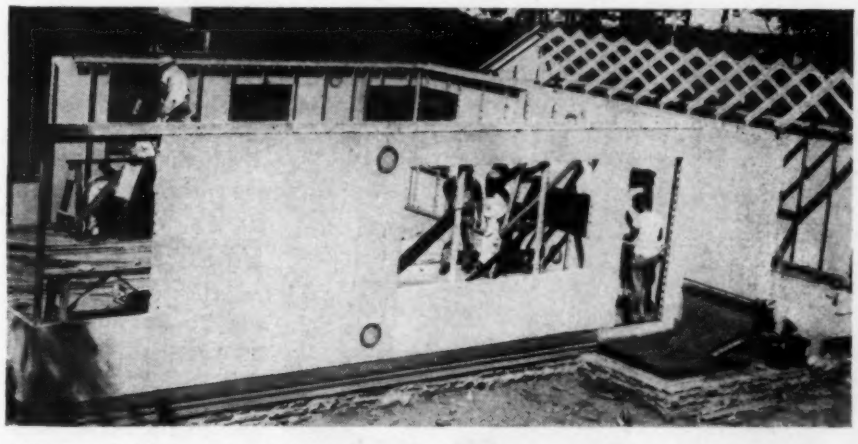
Copper Outlook

The 80th Congress, out to scrap OPA and cut down government control of civilian economy, will have a decided part in determining the continued existence of the RFC metals buying - selling - at - a - loss program and the Premium Price Plan for Copper, Lead and Zinc—but it won't have the last word.

By mid-November the supply-demand outlook for copper and other strategic metals was not encouraging, and forecasts for 1947 indicated a deficiency of copper of more than half-a-million tons. With the Metals Reserve stockpile of copper shrunken to less than 30% of the Jan. 1, 1946 balance and the inability of RFC to meet its quota of imports for the last half of the year, users were beginning to wonder how they would fare in an open world market.

A world shortage of copper, caused by strikes in South American mines and exaggerated by entry into the market of liberated nations who were not trading during the war years, gave promise of trouble for American businessmen who might have to purchase one-third of the country's needs in a heavily inflated world market next year.

Whatever comes out of the Congressional shuffle next spring, metal users will have to do some revising of their budgets to allow for higher costs. Certainly the world market for copper, now hovering at about 17.5 cents, would not go down or stay at status quo. Neither would the domestic price, stabilized by a false economy, stay at the present 14.375 cents a pound. There is no sure way of predicting how high the two markets will go, but it is reasonable to assume they will go up.



All Metal House—Aircraft building techniques are now being used in construction of all metal houses constructed of a thin skin of aluminum over a steel frame. Designed by the Butler Manufacturing Co., St. Louis, Mo., this Pilot model is 24 x 33 ft. and consists of two bedrooms, living room, combination dinette and kitchen, bath and utility room. Exterior walls and roof are aluminum panels which may be left in the original state, painted or covered with stucco. The unit costs $7,000

New Labor Demands Reflect Milder Union Attitude, Fewer Strikes

NEW YORK—Metal trades employers who had hoped to avoid the paralysis of new strikes were jolted recently when John L. Lewis swept into leadership among union leaders demanding additional wage increases and correspondingly costly changes in working conditions.

Although his United Mine Workers (A.F.L.) union still was deadlocked with bituminous mine owners and operators over acceptance of the government-made contract which ended last Spring's damaging coal strikes, Lewis—for U.M.W.—did not hesitate to demand that the six-month-old contract be revised through new government-union negotiations on "wages, hours, rules, practices, differentials," etc.

Misinterpretations Claimed

The demand was prefaced by complaints that government "misinterpretations" of the existing contract had cost miners "millions of dollars," and that these misinterpretations were construed by U.M.W. to be a breach of contract. The strategy was obvious: Lewis' miners customarily refuse to work without a contract, and a breach of the current agreement—as claimed by Lewis—could be interpreted as ending the contract entirely.

The Lewis announcement that "significant changes in the government wage policy"justified U.M.W.'s action capped a number of other rapid-fire and important developments on the labor wage front.

(1) An executive board meeting of C.I.O.'s militant United Auto Workers conferred with Philip Murray, C.I.O. leader, on wage policy, emphasizing pending demands against the Chrysler Corp. The resulting policy statement by Walter Reuther, U.A.W. president, was surprising to everyone because of its mildness.

(2) C.I.O.'s Farm Equipment Workers union announced that it was asking International Harvester to reopen a contract wage clause and negotiate a second-round raise to meet increased costs of living.

(3) Other C.I.O. unions, including the Mine, Mill & Smelter Workers in the nonferrous metals industry, threatened new wage drives as soon as the mid-November convention of C.I.O. in Atlantic City acts on a unified program for balancing higher living costs with higher wages. A.F.L., meanwhile, continued coupling talk of pay rates and productivity gains, but warned at its recent annual convention in Chicago that a determined effort will be made to incorporate U.M.W.-type welfare funds, financed by levies on employers, in all new contracts.

(4) A steady flow of pay boosts indicated that second-round increases already were at hand, and that once a major gain is forced through there will be no stopping the trend short of another helping all around the industrial table.

(5) Resignation of industry members of the National Wage Stabilization Board—long expected—left the future of NWSB virtually on a day-to-day basis.

Aim to End Wage Controls

It was in this ferment and confusion that Lewis dropped his bombshell. The strategic objectives were not hard to see: (1) Lewis would like to drive the final nails into a solid coffin for NWSB and other wage controls; (2) he intends to erase any doubt that he is labor's most militant, and perhaps top, leader by stealing the spotlight from his former lieutenant, and now foe, Murray and the ambitious redhead, Reuther; (3) he is shrewdly conscious that the next Congress very likely will convene with a program of labor control legislation ready for quick passage—hence, that strike action after January 1 might be difficult, and new contract gains in 1947 might be even harder to realize than now.

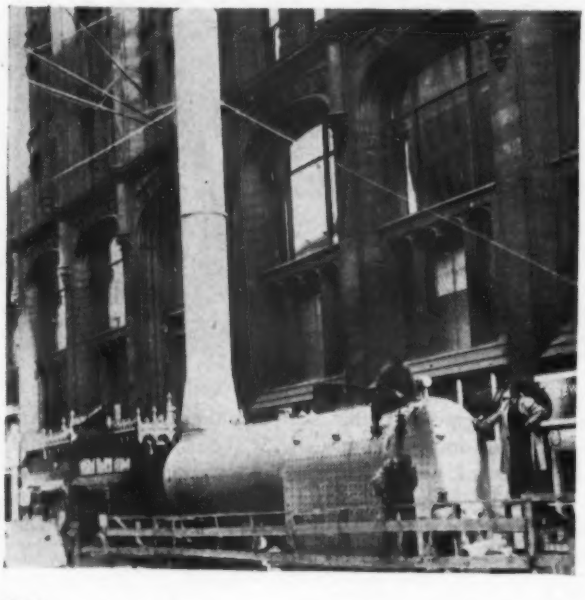
Softpedalling of the auto workers' expected demand for 20% or 25% more pay from Chrysler indicated that U.A.W. is approaching its new Detroit showdown with less vigor than it demonstrated against General Motors. In part, this is due to finances—both union treasury and members' reserves are lower now; in part, it is because Reuther this time heeded the advice of Murray to move cautiously perhaps to leave until after the turn of the year any strong pressure or strike action; and in part it is because Reuther and other board members feel that as long as prices remain in a state of flux any definite demand might be outmoded while under negotiations.

Cooperative Attitude Shown

Result was a conservatively worded wage policy statement that emphasized confidence that a settlement could be worked out at the bargaining table.

Whether that cautious attitude—and a possible decision to move slowly in the auto industry and let Murray's steel union spearhead the real wage attack in January and February—will stand is problematical now. C.I.O.'s carefully mapped strategy might be toppled by Lewis' unexpected move in his industry. A speedup of C.I.O. action is not unlikely.

Meanwhile, any answer to what unions ultimately will ask, and get, continues to hinge on how far up prices go. If a present tendency to high production of household goods carries over into the consumer durable goods field, prices may tend to level off, union demands for more pay will be compromised, and labor unrest will be lessened. But if production is spotty and prices are high, the degree of unrest will be determined only by ability of unions to mount new strike sieges, and the speed and success of congressional action in hammering out new and workable national labor policy.



Strike Ingenuity—During the recent 21-day power strike in Pittsburgh, industrial organizations were forced to resort to unusual methods to provide heat, light and power wherever possible. Workmen are setting up a 150 hp. steam boiler outside the Union Trust building here to supply heat for the 12-story office structure

Foreign Report

BASED UPON MCGRAW-HILL WORLD NEWS BUREAU REPORTS

U. S. Firms In Australia

MELBOURNE, AUSTRALIA — The pegging of the Canadian dollar to the U. S. dollar is intensifying the trend of American companies in establishing subsidiaries in Australia. Before this, American firms had taken advantage of Canada's trade preferences with Australia by shipping parts of their products across the border, assembling them and packing them in Canada for resale in Australia under the Empire Tariff. But Canada's divorce from the sterling block meant that Australian imports from the Dominion were subject to the same exchange restrictions that applied to U. S. exports there since 1939.

American firms found that they could establish manufacturing subsidiaries in Australia with very small investments, due to the availability of idle munitions plants here. Fortunately, Australia's industrialization-minded government is offering attractive lease terms on its war plants, complete with power and water supply and rail sidings.

At least twenty American or U. S.-financed Canadian firms have so far decided to produce here, to convert assembly plants or distributing agencies into manufacturing units, or to expand existing installations. New American investments here will total about $8,000,000 (not including the motor and oil firms), while British overseas sources will provide about $13,000,000.

One attraction to American firms in coming here is Australia's ideal location in trading with eastern markets.

Abolition of double taxation of U. S. firms producing in Australia is likely, since such taxation on British firms is being eliminated.

Among newcomers here are Westclox, General Dry Batteries, General Automatic Sprinkler, Rheem Manufacturing Co., Firestone Tire & Rubber, and Kelvinator. Ford, General Motors and International Harvester are rushing preparations for production of all-Australian cars.

British Steel Shortage

LONDON—Behind American reports of Britain's need for 2,000,000 tons of American steel to support production here, lies the serious prospect of cutbacks in the British motor car industry for 1947 because of a shortage of sheet steel. The government plans to revise allocations of sheet steel which would mean a sharp drop in Britain's exports of motor vehicles, and defer better domestic deliveries and lower prices.

The auto industry claims that it has the capacity to achieve the 1947 goal for both export and home markets.

The Nuffield organization (Morris cars), a leading factor in the industry, has pointed out that it has committed itself to setting up factories in various British areas and in Empire countries, but without adequate steel these plans could not be carried out.

The steel squeeze on the auto industry is arising out of growing requirements of other industries now that their reconversions are completed. Moreover, demand for sheets for Britain's housing program has been increasing.

As a result of this situation, British exports of steel will be cut in 1947 to 1,250,000 tons from the current annual schedule of 2,500,000 tons. But without large imports from the United States, above this year's 500,000 tons, the situation will continue serious.

Progress is being made with the British Iron and Steel Federation's modernization program, but this will not materially affect the 1947 supply.

Indian Industrialization

NEW DELHI, INDIA—Of the 700 Indian industrial workers sent to Great Britain during the war for advanced technical training, 82% are now employed in this country at jobs paying from 200-300% of their pre-training salaries, according to a survey made by the Central Government.

The expanding availability of skilled workers and continuing programs to train many more is in line with India's growing industrialization, as may be illustrated by its machine tool industry (AMERICAN MACHINIST, Oct. 24, p. 152a).

Right now, Indian ordnance workers are turning out 1,000 steam-powered and 500 diesel-powered road rollers, being built under an agreement between the Central Government and Great Britain. Under the agreement, complete boiler and gear units for steam rollers and engines and gear units for the diesel rollers are being imported from Great Britain. All other fabrication work, plus assembly and servicing is to be handled by the Indian factories and by two private firms with the aid of jigs, patterns, designs and technical information supplied by the British manufacturers. The entire program is expected to cost $13,000,000.

Representatives at International Technical Congress—American delegates met recently with officers of the International Technical Congress in Paris to discuss the formation of the World Engineering Conference. L. to r. (front row): Morris L. Cooke, consulting engineer, Philadelphia; Col. A. Antoine, president, International Technical Congress; Col. C. E. Davies, secretary, A.S.M.E.; M. Chalon, president, Societé des Ingenieurs Civils de France; Fenton Turck, president, Turck-Hill Co., N. Y. C.; (back row) E. R. Purves, American Institute of Architects; E. P. Meunier, French delegate general of I. T. C.; George Gilles, president, French Engineering Assns. & Societies; W. J. Hargest, McGraw-Hill Publishing Co., London.

Diversification of Output by Machine Tool Builders Sustains Operations

CLEVELAND—Machine tool builders who have been diversifying their activities over the past year or so to help them withstand the decline in business from the wartime peaks are now acknowledged to have shown considerable foresight. With heavy sales of surplus equipment in recent months cutting into orders for new equipment, tool builders expanding their fields of operation continue to maintain their expanded plant capacity busy and are able to hold together an organization that could function quickly to restore peak machine tool production in the event our national security is again threatened.

Warner & Swasey is an outstanding example of such diversification in this area. Still very much in the machine tool picture where the company intends to remain, this builder is now turning out an array of products that range all the way from its recently developed automatic lathe to earth-moving machines, and knitting machines and other equipment used in the textile field, the latter work being done on a contract basis.

However, Fred H. Chapin, head of the National Acme Co., years ago led his company away from exclusive machine tool production until today that phase of the company's operations constitutes but 50% of its capacity. A good 5% of its capacity is now turning out merchandise for Sears, Roebuck & Co., the balance going into supplies for the electrical and other industries.

One Cleveland tool builder who made many special tools during the war finds itself little affected by WAA's sales of surplus machinery. Products which the company was forced to drop during the war have been made a part of regular production again and because the company has always been devoted to turning out specialized machines, it finds itself with a most encouraging backlog of orders at this time.

Another Cleveland builder, finding that WAA competition cut sharply into its sales, was able to maintain his shop at capacity levels by taking on customer work to take up the slack in machine tool business.

However, the industry remains optimistic over the fact that this year's business will total around $300,000,000, which is not bad by prewar standards when annual shipments averaged $150,000,000. Of course, the 1946 figure represents inflated prices, but even so the industry still has a good six-seven months backlog of unfilled orders. The big problem is how to keep expanded wartime capacity in operation.

Electric Motor Output Rising At Westinghouse Buffalo Plant

BUFFALO, N. Y.—Output of electric motors at the new Buffalo plant of Westinghouse Electric Corporation's Motor Division climbed to approximately 6500 during September compared with about 4700 in August, according to Leon R. Ludwig, manager of the Motor Divsion. Employment has reached a total of 2000 workers and is mounting steadily.

Meanwhile, development of the first all-steel electric motor, an outgrowth of one of the company's wartime manufacturing processes, was announced by Mr. Ludwig. The motor, which incorporates new electrical and mechanical features covered by 15 or 16 patents, is the most revolutionary change in design and manufacture since the electric motor was invented, Mr. Ludwig said. It is being produced in the new plant here.

Smaller, More Powerful Motor—To increase efficiency of machine tools, this all-steel encased electric motor has been developed by Westinghouse Electric Corp. Up to 1/3 smaller than other motors, this one has up to 134% more power per lb. of weight. In this photo, wire coils are being installed in the stationary part of one of the new models under construction in the company's Buffalo plant

Industry Must Disperse, Brown Tells Tool & Die Executives

CHICAGO—Unless atomic energy can be controlled in the next three years, American industry will have to disperse and relocate to achieve the level of 1,000 persons per square mile instead of the 16,000 in Chicago and Detroit, according to Dr. Harrison S. Brown of the Institute for Nuclear Studies at the University of Chicago at the first annual meeting of the National Tool and Die Manufacturers Association at the Congress Hotel, October 23-25. Dr. Brown predicted that another nation in the next three years can "most certainly produce 500 atomic bombs and force the United States to alter its entire concept of military supremacy."

Apprentices Vital

The tool and die industry has lost nearly half of its postwar apprentices because recent amendments to the G.I. Bill of Rights reduced benefits to veterans taking "on-the-job" training, stated Richard F. Moore, association president. Mr. Moore pointed out that it takes four years to train a skilled journeyman tool and die maker and the industry has been starved for apprentices for 16 years. "Unless the government lends a hand," he said, "we are going to be hard-put for skilled help."

A panel discussion on "Good Service on Special Tooling" was one of the features of the program with Burnham Finney, editor of AMERICAN MACHINIST, as principal speaker and moderator.

Officers elected the last day of the meeting to serve during the coming year include: Willis G. Ehrhardt of St. Louis, president; William R. White, Jr. of Chicago, first vice president; J. J. Kohl of Dayton, Ohio, second vice president; Herbert F. Jahn of New Britain, Conn., treasurer; and John H. Benetz of Philadelphia, Pa., secretary.

Improved Statistics Called For At Productivity Meeting

WASHINGTON—The "Conference on Productivity" called here on Oct. 28-29th by the U. S. Bureau of the Budget and the U. S. Bureau of Labor Statistics disappointed expectations of uninformed observers who looked for it to produce new prescriptions for effecting increases in productivity. But the meeting did score some of the advances in clarification of concepts and measures of productivity that were the sole aims of its original sponsors.

Five sessions of the conference took up a dozen different topics in the field, led by more than a score of scheduled speakers drawn from the ranks of government, labor, management, research agencies, and unaffiliated experts.

Main problems for the experts were the definition and choice of proper concepts and measures of productivity at the job, plant, industry, national, and international levels. Only naturally, the largest area of agreement reached by the assemblage was on the need for more and better figures on employment and production from which to arrive at improved productivity statistics at all levels. But possibly the biggest forward step was the clarification of disagreements regarding just what is meant by "productivity," when various people use the term.

Data Lacking

Well aware of the wide disparity between the unparalleled current importance of their subject for wage and other policy decisions and the as yet still limited body of acceptable facts in the field, the conference members confined their disputes about what is the true present state of productivity in the country to only occasional outbursts of argument at the productivity discussion.

Careful distinctions were drawn between such concepts of productivity as the output of goods per unit of labor employed and the output of goods per unit of capital, or machine, and stress was laid on the difficulty of measuring the labor or capital factor's contribution separately.

Emphasis was given to such obstacles to sustaining continuous statistics as when the nature of the product changes on the job or in the industry.

Conflicts were thrashed out over such questions as whether to measure output of automobiles in pounds, in numbers, in value, or otherwise, for purposes of discovering productivity per worker. Inadequacy of data was deplored in such critical cases as the lack of a new census of manufacturers since 1939 from which to derive basic and reliable figures on productivity.

Names in the News

D. S. Harder

E. A. Irwin

D. S. Harder, president of E. W. Bliss Co., Detroit, has been appointed vice president in charge of operations of Ford Motor Co. Mr. Harder will assume his duties as director of all manufacturing and production activities for Ford on Dec. 1. He will remain at Bliss as president until then after which he will continue as director and chairman of the board. **M. L. Bricker,** vice president and director of manufacturing at Ford Motor Co., will continue in his present position with direct line authority over manufacturing operations.

E. A. Irwin, managing director of E. W. Bliss Co. of Canada, Ltd. for the past five years, has been appointed general sales manager of the E. W. Bliss Co., Detroit. Also **Alvin F. Groll** has been placed in charge of the company's sales of mechanical and hydraulic presses, and can and container making machinery in the Cleveland area.

R. V. Hanchett, formerly executive vice president of the Hanchett Manufacturing Co., Big Rapids, Mich., has been elected president of the firm.

Oscar G. Knapp, vice president and treasurer of Clark Bros. Bolt Co., Milldale, Conn., has been named president and treasurer to succeed the late **Edwin S. Todd.**

George H. Kaiser has been appointed district sales manager in charge of the Cleveland office of the Columbia Tool Steel Co.

Robert W. Breckenridge, formerly with the Breckenridge Machine Co., has been elected vice president of Automatic Die & Products Co., Cleveland.

Jerome R. Steen has been named director of quality control for the lamp, fixture, wire products, tungsten and chemicals, radio tube and electronic divisions of Sylvania Electric Products, Inc.

George A. Hays has been appointed vice president and general manager of the Hinderliter Tool Co., Tulsa, Okla., a division of the H. K. Porter Co., Inc., Pittsburgh. He succeeds **Frank J. Hinderliter,** who founded the company in 1920.

Elmer A. Mulson has been named manager of the Pittsburgh district office of the Baldwin Locomotive Works.

Fred C. Ziesenheim has been named sales manager of the Plastics and Die Casting Divisions of The Hydraulic Press Mfg. Co., Mt. Gilead, Ohio, while **Robert F. Ohmer** has been appointed vice president in charge of administration.

John P. Roche

F. C. Ziesenheim

John P. Roche has been named vice president, general manager and director of sales of the Heppenstall Co., Pittsburgh. Since 1944 he has been secretary of Oliver Iron & Steel Corp., Pittsburgh, as well as assistant to the president.

Ben L. Wise, formerly assistant general manager of Federal Machine & Welder Co., Warren, Ohio, has been appointed production engineer of National Electric Welding Machines Co., Bay City, Mich.

James D. Greensward has been named assistant to the vice president of the general machinery division, Allis-Chalmers Mfg. Co., Milwaukee, Wis. Mr. Greensward's duties will be concerned with the company's expansion program. Also, **Ned Landis** has been named branch manager of the Syracuse, N. Y. branch office.

Vern E. Van Saw has been named factory manager of the farm equipment division, Graham-Paige Motors Corp., Willow Run, Mich.

Clyde B. Colwell has been appointed special representative for stainless steels of the Jessop Steel Co., Washington, Pa. His headquarters will be at the Chicago office.

BUSINESS ITEMS

Amgears, Inc. and **American Gear and Manufacturing Co.**, Chicago have been acquired by the **Hupp Corp.** Operations of the companies will be consolidated at the American Gear plant at 6633 W. 65 St.

Clarence Johnson, research engineer of the Bailey Meter Co., Cleveland, for 18 years, is now a research consultant on inventions and engineering developments in Beloit, Wis.

Crucible Steel Co. of America has opened a new warehouse and office at 4501-4531 W. Cortland St., Chicago.

Skilsaw, Inc., Chicago, has purchased the **Forss Pneumatic Tool Co.,** Aurora, Ill., manufacturer of small, portable pneumatic tools.

Wheelco Instruments Co., Chicago, has opened a distrtict sales and service office at 107 So. Capitol Ave., Indianapolis, Ind. under the direction of **John E. Anderson** to cover most of Ind., western Ohio and Ky.

United Aircraft Products, Inc., Dayton, Ohio, has purchased the **Allen Tool & Manufacturing Co.,** Springfield, Ohio manufacturers of jigs, dies, fixtures and special machinery for aircraft factories during the war. They are now specializing in airport service equipment.

Ladish Drop Forge Co., Cudahy, Wis. has opened a Chicago office at 332 So. Michigan Ave. **W. O. Kupper,** newly appointed manager of Middle Western Sales, will be in charge of the office.

American Screw Co., Providence, R. I. will begin moving to its new plant in Willimantic, Conn. this month. It is expected that the gradual move will take about a year to accomplish.

Schaible Co., Cincinnati, Ohio has acquired the **Trenton Stamping & Manufacturing Co.,** Trenton, Ohio.

Automotive Maintenance Machinery Co., 2100 Commonwealth Ave., No. Chicago, Ill. has changed its name to **AMMCO Tools, Inc.**

Industrial Powders, Inc., 220 Essex St., Brooklyn, N. Y. has been formed to produce electrolytic copper and copper oxide powders for all metallurgical uses as well as for the paint, electrical, plastics, chemical and automotive industries. **G. B. Gusrae** is production engineer of the firm while **Arthur Bass** is sales manager.

Cutler-Hammer, Inc., Milwaukee, Wis. has established a new southwestern district sales territory. The new district will be under E. K. **Anderson** at 715-A N. Ervay St., Dallas, Texas.

St. Joseph Structural Steel Co., 8th & Atchison Sts., St. Joseph, Mo., has been incorporated by **T. W.** and **E. M. Dodd** and **Robert B. Chesney** to engage in the manufacture of structural and other iron, steel and nonferrous metals.

E. W. Carpenter Mfg. Co., Bridgeport, Conn. has been purchased by **D. Wheeler Clark** and 10 associates. Officers of the firm now include: Mr. Clark, president; **William T. Leete,** vice president and works manager; **William H. Fry,** vice president and chief engineer, and **Harry Eick,** superintendent of manufacturing.

Elm Corp., Middletown, Conn., has been formed by **Louis H. Tallmadge, Wolcott E. Merrow, John G. Merrow** and **Everett Champlin** to manufacture, rebuild and repair machinery.

OBITUARIES

R. S. Drummond

Robert S. Drummond, 62, who founded the National Broach and Machine Co., Detroit, 17 years ago, died Oct. 9 after a two months' illness. He served as president and director of the firm until his death. Mr. Drummond was recognized as an international authority on gear practice and gear finishing. Before forming National Broach, he was with the Gear Grinding Machine Co. and the Detroit Steel Products Co.

Frank H. Stephens, 71 retired executive of Allegheny-Ludlum Steel Corp., died Oct. 10 in Pittsburgh. He had served with Allegheny-Ludlum's predecessors since 1901 and was a vice president and director. He retired two years ago, retaining his post as director and being named honorary vice president.

Major M. Poole, 65, purchasing director of E. C. Atkins & Co., Indianapolis, Ind. passed away Oct. 4. He had been associated with the company for 46 years and in 1940 was appointed a director of the board and director of purchases.

William H. Pratt, 79, founder and head of Goodell Pratt Co., Greenfield, Mass., passed away recently.

George Hearn, 79, former president of the Riker Manufacturing Co., Rochester, N. Y., died Oct. 6.

John C. Clabaugh, 93, passed away Oct. 13. He was connected with the Southern States Steel Co. and its successor, Gulf States Steel, until his retirement in 1941.

MEETINGS

American Management Association. Production meeting. Palmer House. Chicago, Ill. Nov. 14-15. American Management Association, 330 W. 42 St., New York 18, N. Y.

American Society for Metals. Municipal Auditorium, Atlantic City, N. J. Nov. 18-22. Graves Taylor, 7301 Euclid Ave., Cleveland 3, Ohio.

American Welding Society. Annual meeting. Atlantic City, N. J. Nov. 17-22. American Welding Society, 33 W. 39 St., New York 18, N. Y.

Industrial Management Society. Tenth Annual National Time and Motion Study Clinic. Hotel Continental, Chicago, Ill. Nov. 6-8. R. R. Landes, general chairman, 176 W. Adams St., Chicago 3, Ill.

National Association of Manufacturers. Annual Congress. Waldorf-Astoria Hotel, New York, N. Y. Dec. 4-6. National Association of Manufacturers Association, 14 W. 49 St., New York, N. Y.

National Exposition of Power and Mechanical Engineering. Grand Central Palace, New York, N. Y. Dec. 2-7. Charles F. Roth, manager, Grand Central Palace, New York, N. Y.

National Materials Handling Exposition. Public Auditorium. Cleveland, Ohio. Jan. 14-17. Ezra W. Clark, chairman, P. O. Box 178, Battle Creek, Mich.

National Metal Congress and Exposition. Municipal Auditorium, Atlantic City, N. J. Nov. 18-22. W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

Society of Automotive Engineers. National Fuels and Lubricants meeting. The Mayo, Tulsa, Okla. Nov. 7-8. Annual meeting and engineering display. Book-Cadillac Hotel, Detroit, Mich. Jan. 6-10. John A. C. Warner, general manager, 29 W. 39 St., New York, N. Y.

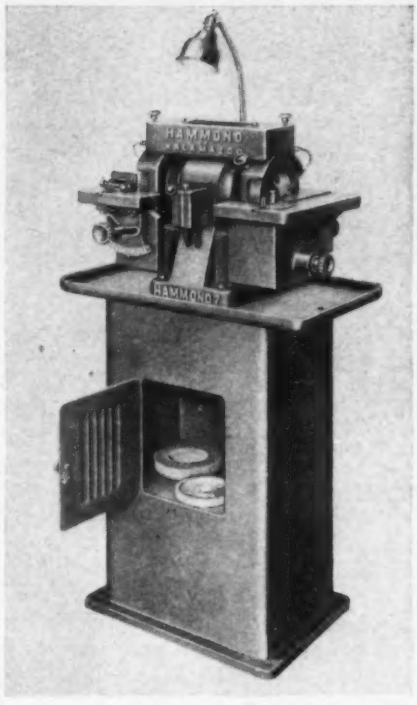
Shop Equipment News

Units shown here have not been described previously in our pages and are being exhibited for the first time at the National Metal Show in Atlantic City, Nov. 18-22, 1946

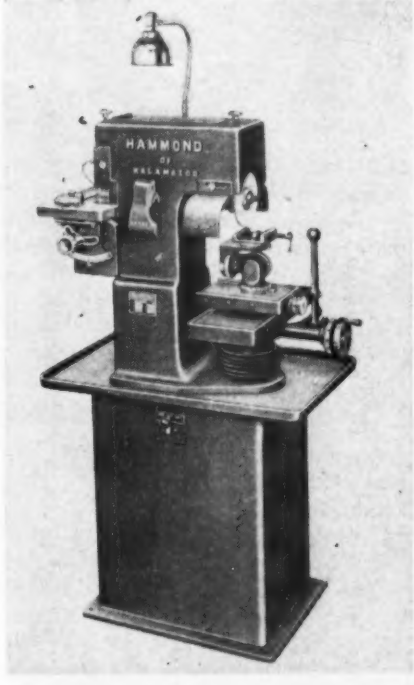
Hammond Machinery Builds Grinders For Carbide Tools, Diamond Finishing

Two new machines, a 7-in. carbide tool grinder and the Model CB-77 combination chip breaker and diamond finishing grinder, are announced by Hammond Machinery Builders, Inc., Kalamazoo 54, Mich.

The 7-in. carbide tool grinder is of heavy-duty construction to permit use of diamond wheels. The tables have screw feed to avoid wheel damage and give the operator positive control over the table position. One handwheel unlocks the table and permits setting to any angle from 30° below to 25° above the horizontal. A one-piece drip-feed tank which serves both wheels when diamond-wheel grinding is removable.

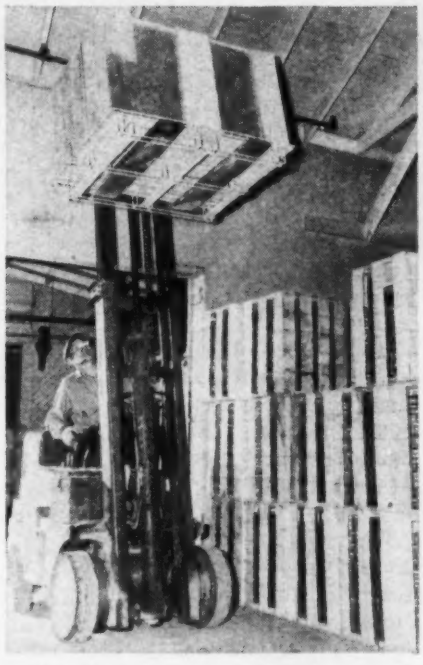


Hammond carbide-tool grinder has screw feed tables to give the operator positive control over table position



Hammond combination chip breaker and diamond finishing grinder includes a vise with four swivels

The Model CB-77 combination chip breaker and diamond finishing grinder accommodates either 6- or 7-in. diameter wheels on the cup wheel side. The table moves in and out by screw feeds. The vise on this machine handles any size tools and has four swivels to provide any angle. The first is for side cutting edge, the second for back rake angle, the third for side rake angle, and the fourth for the chip breaker groove angle. Every angular reading is direct and each swivel can be locked so the vise forms one rigid unit. There is a ball-bearing table on the chip breaker side.



PALLET—An 8-way wire pallet is announced by Union Steel Products Co., 445 Pine St., Albion, Mich. Made from steel wire, the pallets are accessible from any side or corner with a fork-lift truck

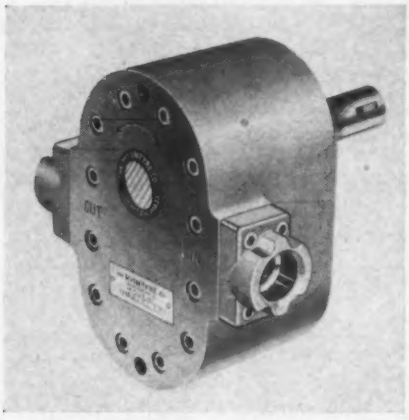
Handy & Harman Brazing Alloys Have 35%, 45% Silver Content

Two silver brazing alloys, Easy-Flo 45 and Easy-Flo 35, are announced by Handy & Harman, 82 Fulton St., New York, N. Y.

Easy-Flo-45 contains 45% silver and has a flowpoint of 1145 F. This is said to be the lowest working temperature of any alloy capable of making high-strength joints. The alloy is said to be extremely fluid at its working temperature, assuring deep penetration.

Easy-Flo 35 has a silver content of 35% and a flow point of 1295 F. This alloy permits more economical brazing of ferrous, non-ferrous and similar metals where this temperature is not objectionable.

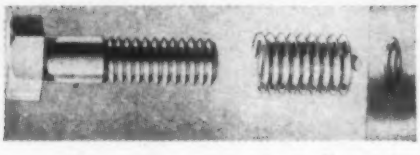
McIntyre Series 600 Pumps Are for High-pressure Use



The Series 600 hydraulic pumps for high-pressure applications are announced by the McIntyre Co., 15 Riverdale Ave., Newton 58, Mass. Designed for materials-handling equipment, machine tools and other applications, they are direct-drive, spur-gear pumps.

The pumps of this series have an average weight of 16 lb., a volumetric efficiency of better than 90%, and a mechanical efficiency in excess of 80% at working pressures of 1000 psi. At 1750 rpm., three models deliver 1.4 to 34.2 gpm., with power requirements ranging from 1 to 24 hp. Standard models are designed for direct motor application, but can be furnished for flange, belt, spline, and other drives.

Stainless-Steel Wire Inserts For Threads of Soft Material

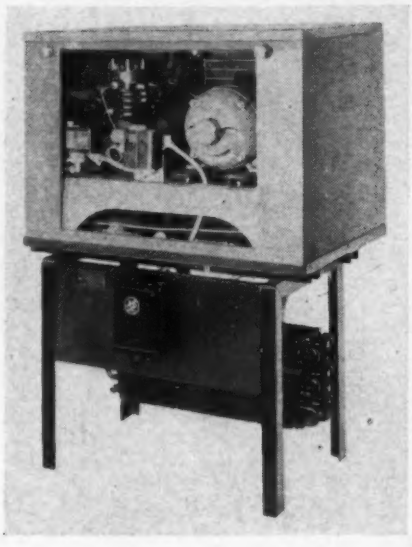


Helical coils of stainless-steel wire which are used as a bearing surface for tapped threads in light metals, plastics, and other materials are produced by the Aircraft Screw Products Co., Inc., Long Island City, N. Y. Known as Aero-Thread and Heli-Coil Inserts, they are used where wear of the tapped threads is likely to occur.

The insert is made of wire in a diamond cross section and is inserted into the tapped thread with a special inserting tool. The insert is slightly larger than the tapped hole, but is constricted by the inserting tool so that it can be installed readily. When released, the spring tension in the coil forces the outer edges snugly into the tapped thread holding the insert in place.

The Heli-Coil insert is designed to fit American National V-threads. The Aero-Thread has a special profile in the wire, with the inside rounded to fit into a round valley in the stud or screw. This is said to eliminate the V notch in the screw or stud, and remove a common cause of failure.

Hoffman Refrigeration Units Control Coolant Temperature



Refrigeration units for control of coolant temperatures are produced by United States Hoffman Machinery Corp., 105 Fourth Ave., New York 3, N. Y. They are designed for use in precision operations, such as thread-grinding, lapping, and honing, and in machining materials such as magnesium, where the use of coolants close to room temperatures is desirable.

The equipment is designed for operation under shop conditions, and is available either with immersion coils or with heat exchangers. The unit illustrated is Type A which is a 1-hp. unit.

Carpenter's New Die Steel Heat-treats at Low Temperature

A new air-hardening die steel has been developed by the Carpenter Steel Co., Reading, Pa. This steel is said to provide tool and die makers with easy, low temperature heat-treatment, uniform hardening in heavy sections, and minimum distortion and size change.

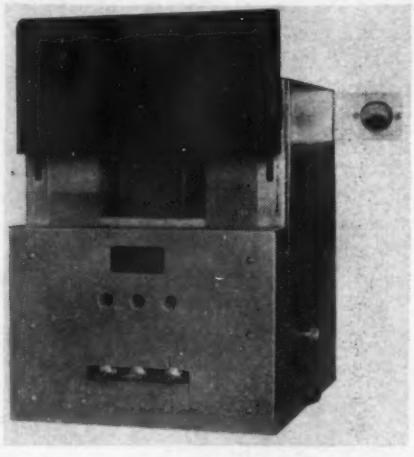
Pyrometer's Surface Instrument Includes Eight Thermocouples

An improved surface pyrometer for measuring metallic or non-metallic surfaces is announced by the Pyrometer Instrument Co., 103 Lafayette St., New York 13, N. Y.

The instrument is mounted in a rubber-cushioned steel housing which protects it from external magnetic influences, and makes it shock, moisture, and dust proof. An internal automatic cold-end junction compensator is included so that external temperatures will not affect the reading.

Eight different thermocouples and two types of extension arms are included with the set. The operator places the desired thermocouple into the locking connectors, which is done without the use of tools, and makes contact with the surface.

The pyrometer is available in five models which have upper temperature limits of 300 to 1200 F.



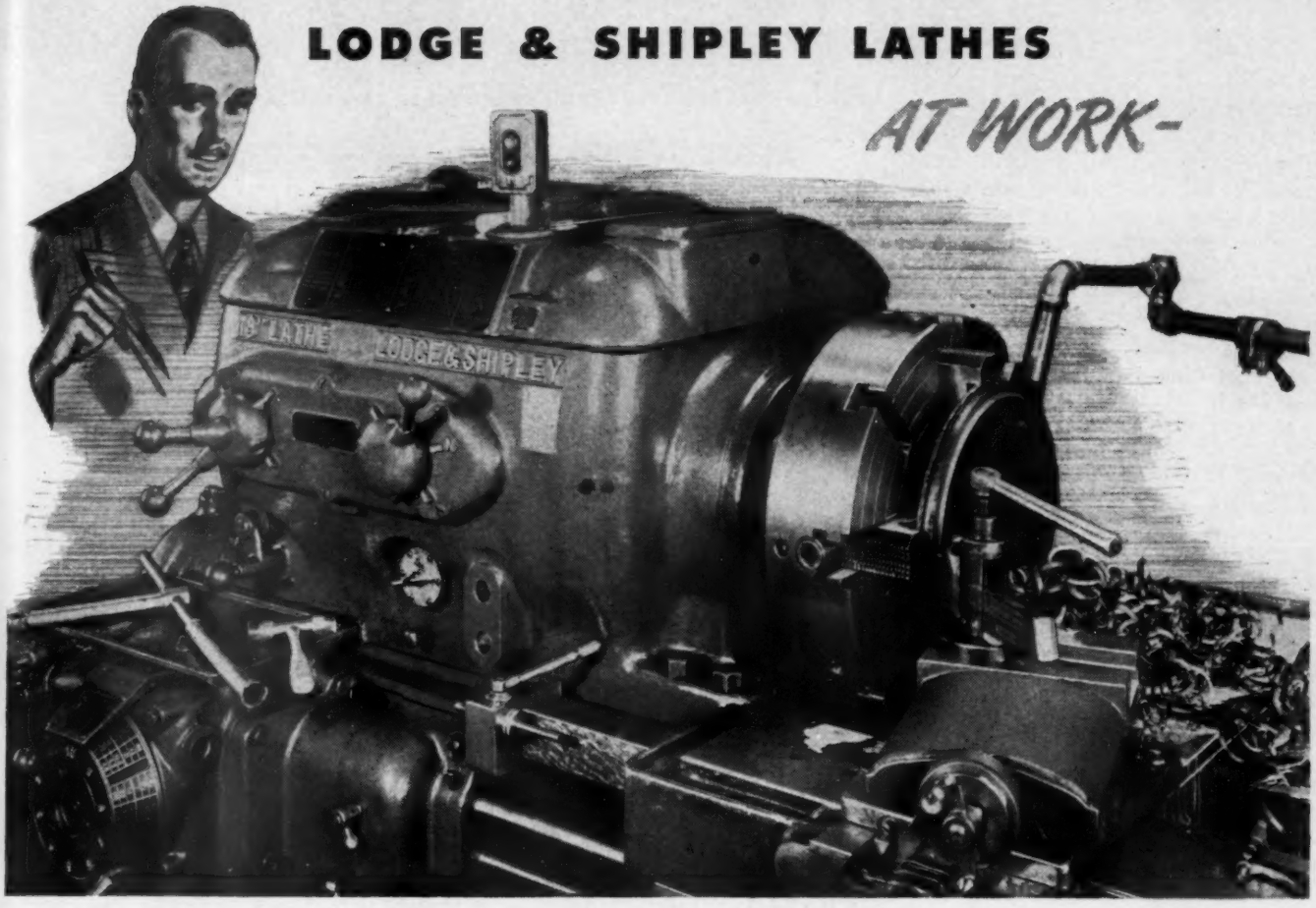
FURNACE—This Universal Laboratory furnace has accessories that permit its use as a direct-fired unit, a muffle unit, or as a pot-type unit. It is built by Surface Combustion Corp., Toledo 1, Ohio

Vanadium-Alloys Tool Steel Has A High Carbon Content

A cutting material with carbon content said to be higher than any previously produced, "Vasco Supreme" is announced by Vanadium-Alloys Steel Co., Latrobe, Pa.

The high carbon content results in increased wear resistance and contributes to high hardness from heat-treatment. The addition of 5% vanadium prevents brittleness and increases the hardness at elevated temperatures. Cobalt is added for

LODGE & SHIPLEY LATHES AT WORK-



OUTPUT: "greater than any lathe in our shop"
ACCURACY: "by far the most accurate lathe"

AMERICAN MFG. CO., TACOMA, WASH.

Rather broad statements you might think. But they're backed up by actual experience in this noted plant . . on every day production of a wide variety of precision machine parts—axles, gears, sprockets, worms, bearings, cylinders, clutch yokes and valves.

On every type of machining operation: turning, boring, facing, threading and tapering, this customer found the Lodge & Shipley lathe unequalled. In producing their plywood and sawmill machinery as well as passenger, industrial and freight elevators, American Mfg. Co., production men noted that "The bulk of our precision work is handled by the L & S—because of its accuracy, time is saved."

This exceptional performance is typical of outstanding results reported by users of the new series of 18, 20 and 22 inch L & S Lathes. These lathes are completely new and improved in every detail from pulley to tailstock . . . can do your work better and at far lower cost—possibly replace several older, worn and weary tools.

L & S Engineers will be glad to show you actual cost and production figures . . . demonstrate on your own work just how these modern lathes can improve your production—cut your costs. Write on your company letterhead for detailed information in Bulletin Nos. 503, 605 and 606.

ENGINE
TOOL ROOM
MANUFACTURING
OIL COUNTRY
DUOMATIC (AUTOMATIC) LATHES

THE LODGE & SHIPLEY MACHINE TOOL CO.

L & S LATHES

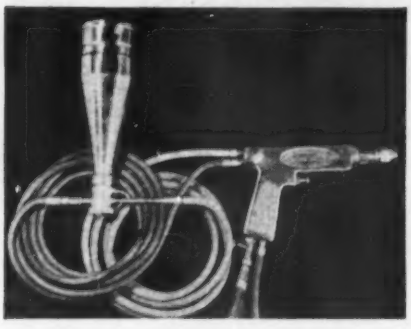
CINCINNATI 25, OHIO, U. S. A.

MACHINE TOOL DIVISION 3055 COLERAIN AVE. • SPECIAL PRODUCTS DIVISION 800 EVANS ST.

further improvement of the "hot hardness" qualities.

The material is said to have a high edge strength and ample toughness for all applications, including intermittent cutting. It is said to be capable of operating at speeds 15 to 100% higher than 18-4-1 and 6-6-2 high-speed steels. It is said to have the ability to take sharp cutting edge angles, and to be suitable for machining hard cast iron and cast steel.

Colmonoy Hard-facing Alloys Applied With Spraywelder Unit



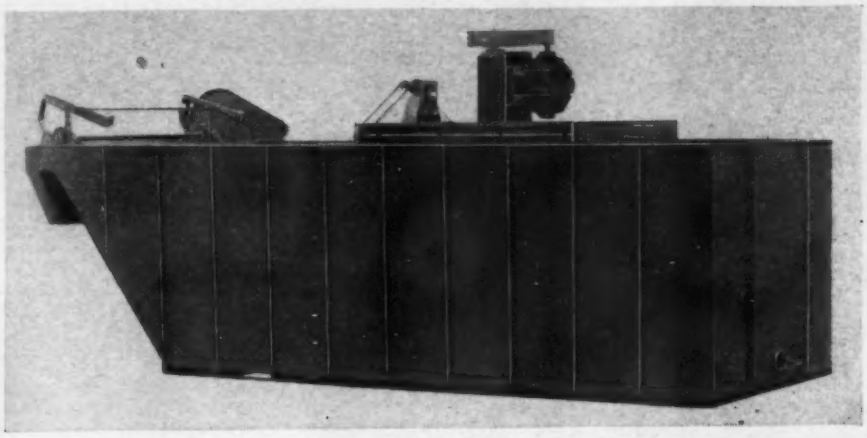
A unit for use with powdered Colmonoy hard-facing alloys, the Spraywelder, is announced by Wall Colmonoy Corporation, 720 Fisher Bld., Detroit 2, Mich. The unit consists of a gun, air hose, oxygen and acetylene hoses with connections to fit standard regulators, and carburetor and hoses.

The Spraywelder has four controls. The oxygen and acetylene controls are located on the handle. The valve for controlling the propellant air and the valve for controlling rate of powder flow are located on the side of the Spraywelder. A carburetor incorporated in the hopper of the unit maintains a steady flow of powder when adjusted.

In using the unit, the initial steps are similar to standard metallizing procedures. The hard-facing alloy is applied to the desired thickness. It is then fused to the base metal with (1) oxy-acetylene equipment, (2) induction equipment, or (3) controlled atmosphere furnace. The result is said to be a smooth, uniform overlay fused with the base metal.

The Sprayweld unit is used with Colmonoy No. 6 alloy. It is recommended that the method not be used where the thickness to be applied before fusing is more than 0.075 in. This will shink about 20% in fusing, with a final recommended maximum thickness of 0.060 in.

U. S. Hoffman Coolant Clarifier Uses Mechanical Cleaning Method



Flotation unit for cleaning coolant. The process is entirely mechanical with no added materials required

A process for removing waste solids from coolant which consists of soluble oil and water is announced by United States Hoffman Machinery Corp., 105 Fourth Ave., New York 3, N. Y. The new process is a modification of equipment used for some time by American Cyanamid Corp.

The clarifier consists of a simple tank, a rotor-stator agitator, and a source of power. As dirty coolant enters the tank, it is aerated by the rotor-stator, which produces a dispersion of air bubbles throughout the liquid. These bubbles attach themselves to solid particles, carry them to the surface, and concentrate them in a froth.

The froth is removed continuously by slow speed, power-driven paddle wheels and discharged into a sludge receptacle. The solids settle out and the excess liquid portion is drained off and returned to the clarifier.

The equipment is fully automatic. The only attention required is occasional dumping of sludge. The clarity of coolant treated by this process is said to be wholly adequate for most operations.

Sheffield X-ray Gaging Unit Will Check Moving Material

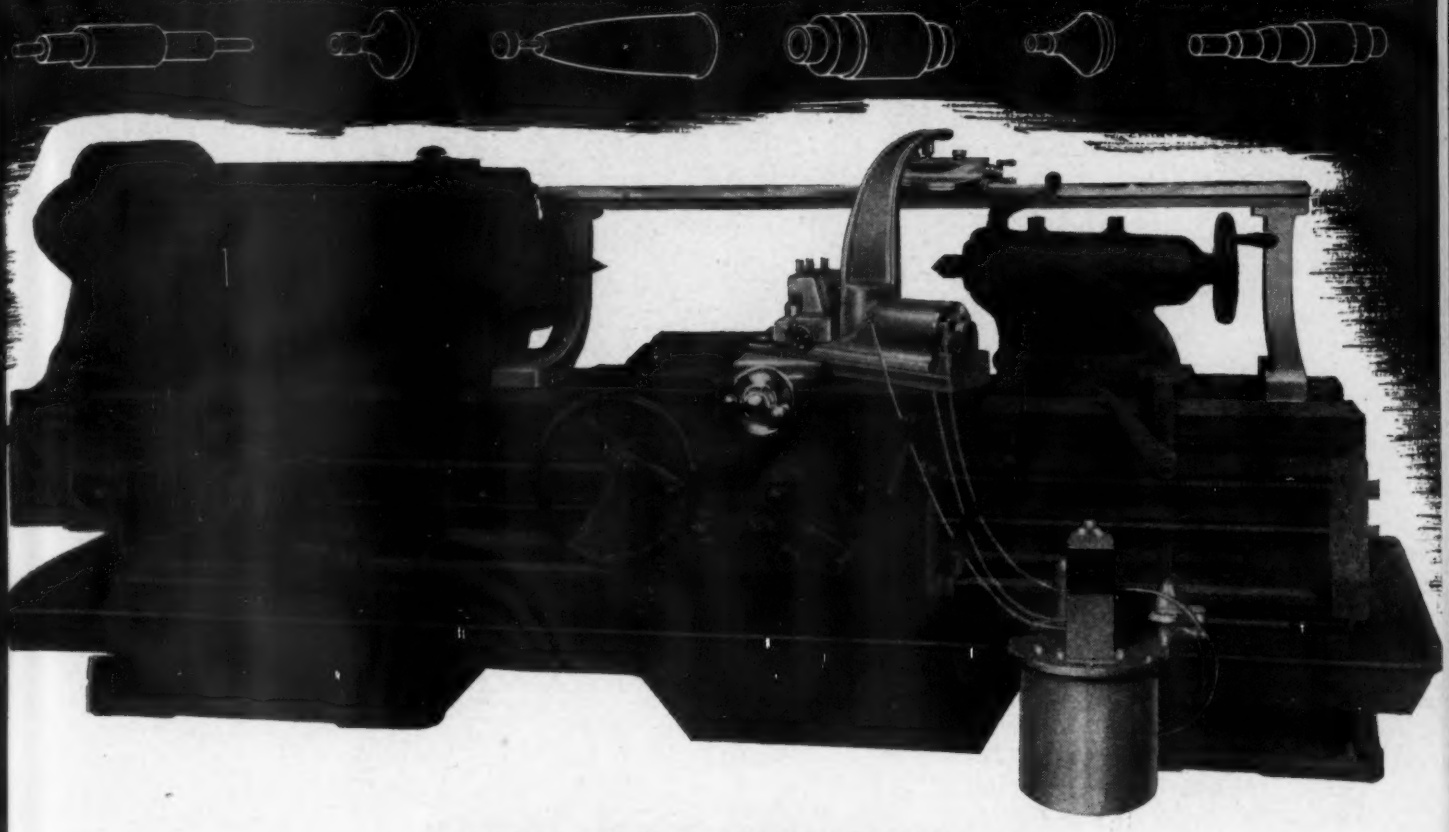
A gaging instrument which checks thickness of all types of moving materials without contacts, known as Measuray, is announced by the Sheffield Corp., Box 893, Dayton 1, Ohio.

The Measuray can be applied to almost any production process. Its accuracy is said to be better than one percent of material being checked if required. Tolerance and thickness limitations are dependent to some extent on the density of the material to be checked. Speed of the material has no effect on the accuracy of the instrument.

Utilizing an X-ray and electronic application, the Measuray serves as a comparator. It compares the thickness of material with a sample of the same material and variations are

A non-contact method for either continuous or spot-checking the thickness of moving material is possible with the use of X-rays in this gaging unit made by Sheffield

FOR TURNING CONTOURS AND STEP SHAFTS



THE NEW EXCLUSIVE

MONARCH "AIR-TRACER"

FORMERLY KNOWN AS THE BAILEY DUPLICATING ATTACHMENT

Stepless increasing contours—machined to correspond to the template within a limit of tenths—and with a continuous finish that often eliminates subsequent grinding operations!

That's the kind of work you can do—*and faster*—with a new Monarch "AIR-TRACER" equipped lathe. You'll get greater precision—*greater production*—on increasing contours and on step shaft work, too. (Automatic sizing is an important integral feature.)

The "AIR-TRACER" has a proved production record for saving time, money and material on such diversified work as mandrels, punches, dies, nozzles, spinning chucks, impellers, valves, metering pins, molds—*and a wide range of step shafts.*

If you're doing these classes of work, you'll want to know all about the new Monarch "AIR-TRACER", offered exclusively on new Monarch Turning Machines equipped at the factory. You can get complete, detailed information in Bulletin 2601. Ask for your copy.

Check these advantages

- ★ **Stepless cutting-tool motion—*for increasing contours and a superior continuous finish.***
- ★ **Air-gage sensitivity combined with hydraulic power's versatility and ease of control—*an exclusive Monarch feature.***
- ★ **Automatic sizing eliminates repetitive setups and measurements—*for faster production, fewer rejects.***
- ★ **Continuous feed of slide on increasing diameters—*for more uniformly high finishes.***
- ★ **Exact conformance to template contours—*changes in template shape translated instantly into slide movement.***
- ★ **Feed infinitely variable from 0 to 20" per minute—*for maximum machining efficiency on all materials and diameters.***

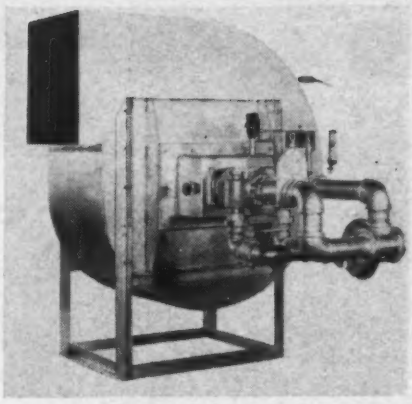
THE MONARCH MACHINE TOOL CO.

Sidney, Ohio

Monarch TURNING MACHINES

indicated in percentages. No contact is required with the material to be gaged, and in some cases the nearest approach of the instrument can be several inches. All thicknesses of steel tubing, for instance, can be checked at any point without cutting the tubing. The material being checked can move or whip up and down within practical limits in the space between the X-ray source and the detector without disturbing the accuracy of the instrument.

Four standard Measuray units are available. Thickness, density, and type of material, as well as tolerances to be checked, determine which of the units is to be used for a particular application.



HEATER—Scroll-type heater, designed for use in convection heating applications is produced by Surface Combustion Corporation, Toledo 1, Ohio

Progressive Flash Welder Handles Aluminum Sections

A flash welder said to be capable of handling fairly heavy sections of aluminum has been developed by Progressive Welder Co., 3050 E. Outer Drive, Detroit 12, Mich. The machine is operated with storage batteries.

A new mechanical actuation of the machine is said to make possible flash welding of aluminum on a production basis, even with a limited power supply.

Another new development is a 30-gun automatic welding machine which utilizes a low reactance circuit to provide a new technique for multiple spot welding.

This concludes descriptions of new items to be shown at the National Metal Show which had been received at time of going to press.

Broaching Machines and Presses Are Built by Acme Broach Corp.

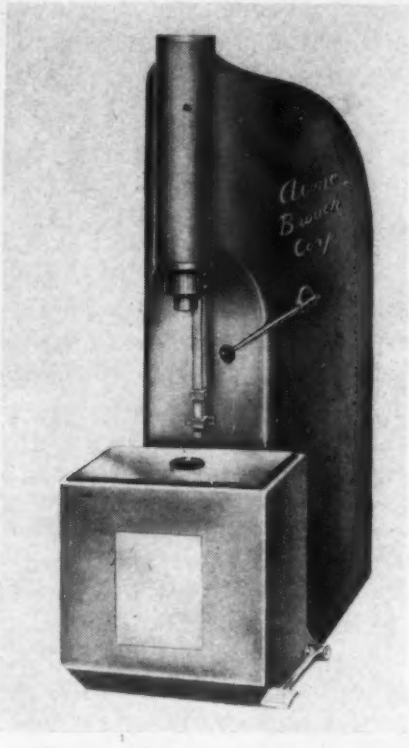
Acme horizontal broaching machines are designed with trim lines so the operator can keep them clean with a minimum of effort

A line of hydraulic broaching machines and presses has been announced by Acme Broach Corp., E. 3rd St., at Delaware, Lexington 47, Ky.

The horizontal broaching machines are said to be easily set up for a wide variety of work. In the majority of cases, they can be changed from one job to another by changing to the proper size face plate or work horn and inserting and aligning the proper broaching tool. The filler spout for the hydraulic oil reservoir is placed under the hood where it is accessible to the operator, but not exposed.

The motor, hydraulic pump, and control valve are mounted on a common base which can be removed for inspection and servicing. The pull bolt that receives the broach puller is provided with a tightening nut to provide positive positioning for the broach puller. The machines are made with normal capacity of 2, 4, 6, and 10 tons, as well as in larger sizes.

The hydraulic presses are manufactured in a range of sizes suited to many broaching, assembling, forcing, and straightening operations. They can be operated either by hand or foot controls, with the operator in either a standing or sitting position.



All hydraulic piping and fittings of the Acme presses are contained in the machine column and are accessible through an opening in the back

The work plate on top of the work table is an individual, ground steel plate supported by ribs in the table. The presses are made with normal working capacity of 2, 4, and 6 tons. The stroke is 24 in.

4-WINGED DRIVER CAN'T SLIP OUT OF PHILLIPS TAPERED RECESS

AMERICAN PHILLIPS SCREWS are "FIRST MATES" Cost-wise

...BOTH TO BOAT-BUILDERS AND OWNERS

In shipyards (as in automobile plants, refrigerator factories — *or what's yours?*) American Phillips Screws deliver these special savings: Swift, sure-handed handling. Automatically straight driving. Protected, unspoiled work-surfaces. More and better work done far more easily. All of which translate into TOTAL TIME-SAVINGS AS HIGH AS 50%!

And American Phillips savings reach straight through to the buyer of the boat. For these screws resist corrosion, withstand vibration, remove screw-driving from his maintenance work, help to keep his craft always trim, tight, and shipshape.

You can steer by this: American Phillips Screws are profitable not only production-wise. They're potent sales promotion, as a mark of quality construction . . . and they're sound sales-protection, too. *You* can get these same production and sales advantages in American Phillips Screws in any type or metal (see below) for any fastening requirement. Write.

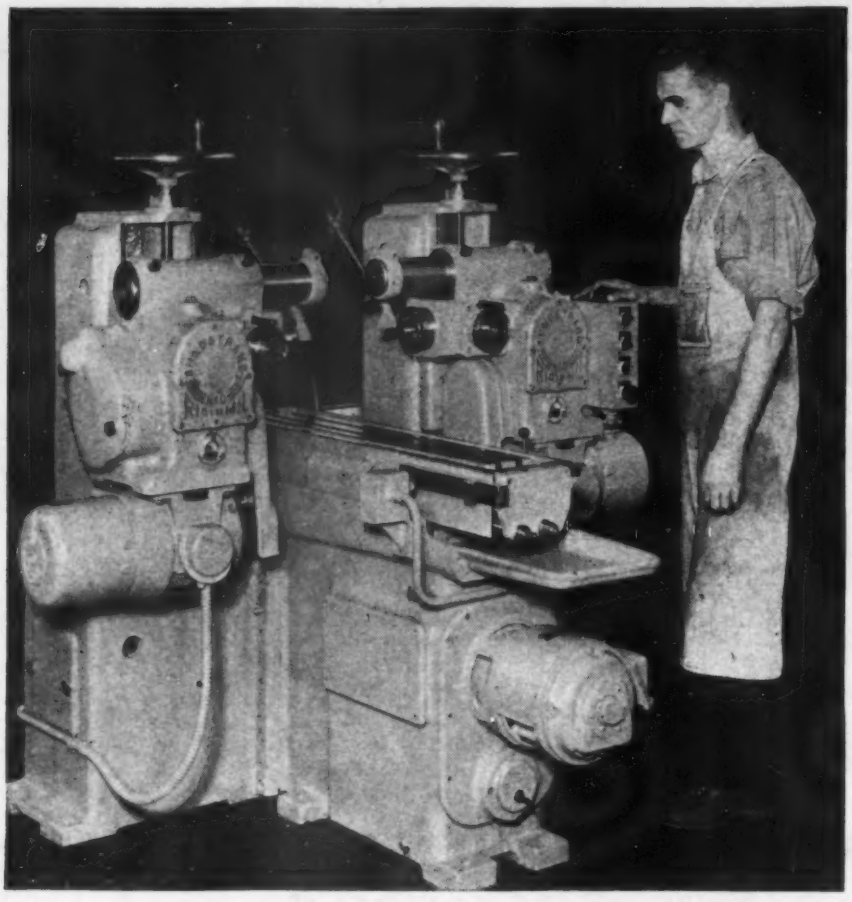
AMERICAN SCREW COMPANY, PROVIDENCE 1, RHODE ISLAND

Chicago 11: 589 E. Illinois Street *Detroit 2:* 502 Stephenson Building

AMERICAN PHILLIPS *Screws*

ALL TYPES
ALL METALS: Steel, Brass, Commercial Bronze, Stainless Steel, Aluminum, Monel, Everdur (silicon bronze)

Sundstrand Duplex-type Rigidmil Mills Two Surfaces on Small Work



Small parts, such as those for typewriters, guns, and business machines, can be milled on two surfaces in this small duplex-type Rigidmil

A small duplex-type Rigidmil, No. 0, is announced by the Sundstrand Machine Tool Co., Rockford, Ill. It is designed to reduce time and machining costs by milling two surfaces simultaneously on opposite ends of small work pieces, or for taking light cuts on larger work.

The two horizontal-opposed spindle heads have independent vertical adjustments from 2 to 13 in. from top of table to center line of spindle. Cuts can be made at different relative heights.

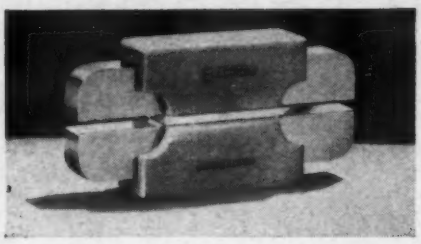
The spindles are independently driven by either 1- or 1½-hp. motors. Two speed ranges are available from 25 to 1200 rpm., or 50 to 2400 rpm. Speed changes are accomplished by pick-off gears.

The columns are mounted and keyed to wing or base members, and can be placed in any of three positions each, providing a total increased spread of 7 in. between spindle noses. Each spindle is mounted in a quill which has 1¾-in. endwise adjustment. With columns in the inner fixed position and quills fully extended, the distance between spindle noses is 5⅞ in. With columns in the outer position and quills fully retracted, distance between spindle noses is 16⅜ in.

Feed and rapid traverse movements of the table are controlled hydraulically by a Sundstrand hydraulic feed unit mounted in the base. Maximum stroke of the table is 12 in., and rate of table feed is infintely adjustable between ½ and 38 ipm. Rapid traverse rate in 325 ipm. Dogs mounted to the machine table are used to adjust the length of feed and rapid traverse stroke.

Snap Gages Made by Dearborn Have Special Gage-block Spacer

A snap gage which incorporates special gage blocks as spacers is announced by Dearborn Gage Co., 22038 Beech St., Dearborn, Mich.

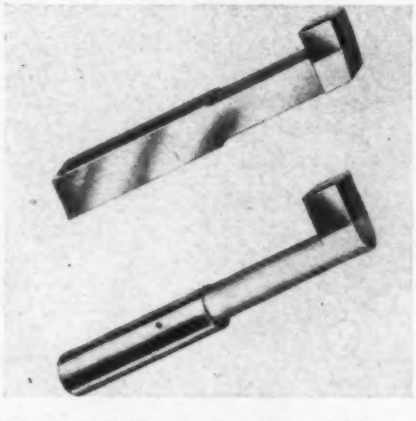


Known as the Ellstrom "Mastersnap," it consists of a special gage block wrung between a pair of chromium-plated alloy-steel jaws and locked in position by brass thumb fasteners. Colored plastic insulators, green for "go" and red for "no-go" are fitted over the jaws to complete the assembly.

It is said that the gage blocks are not subjected to wear by this arrangement and can be assembled to the desired size with no special skill on the part of the user. Special gage blocks are available in sizes from 0.050 to 2.000 in. which may be used separately or in combination. Separate assemblies are required for "go" and "no-go" combinations.

Optimus Equipment Co. Builds Line of Degreasers

A complete line of metal-parts degreasers in standard and special models is announced by Optimus Equipment Co., 151 Church St., Matawan, N. J. Machines in the new line will embody a varied number of cleaning cycles, including vapor, vapor-spray, liquid-liquid-vapor, and liquid-vapor.

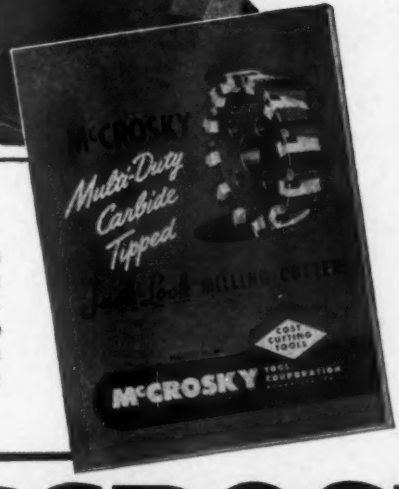


BORING BITS—Carbide-tipped boring bits with round and square shanks are made by Samuel S. Gelber Co., Dept. H, 542 West Washington Blvd., Chicago 6, Ill. They are made in two grades, one for cutting steel and one for general-purpose work, with shanks of heat-treated alloy steel

McCROSKY leads again with these new Multi-Duty Carbide Tipped MILLING CUTTERS...

UNLIKE earlier carbide tipped cutters, designed and suited for use on one machine and one set of work conditions only, these new McCrosky Multi-Duty Cutters are general purpose tools. They can be used on job after job, and on one machine after another. The number of blades, and the rake and spiral at which the blades are mounted in the cutter bodies makes these tools ideally suited for a wide variety of medium duty work. Yet, the tools are amply proportioned and rugged enough for use on the new super-powered machines that have recently been developed.

McCrosky Multi-Duty Carbide Tipped Cutters are available in two styles,—one for milling cast iron and non-ferrous metals,—the other for steel. Both feature the Jack-Lock blade locking device—conceived and perfected by McCrosky engineers—that gives McCrosky inserted blade tools the rigidity of solid tools on the job,—yet permits quick release of the blades, and easy and accurate adjustment so that a minimum amount of blade stock is lost in regrinding.



BULLETIN No. 461

—gives full details—lists prices, etc., of the most popular sizes,—and formulas for determining safe operating factors when milling steel. Send for a copy today.

McCROSKY TOOL CORPORATION
MEADVILLE, PA.

COST CUTTING TOOLS

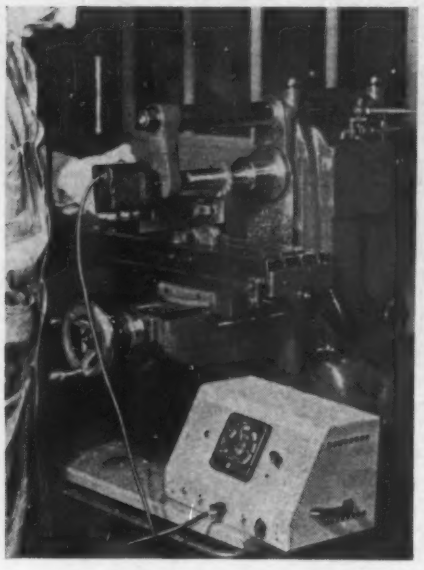
Designers and Manufacturers of

Jack-Lock Milling Cutters — *Super Adjustable* Reamers

Block Type Boring Bars — *Turret* Tool Posts

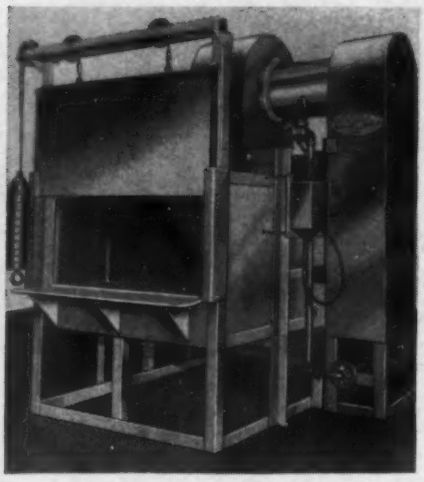
Wizard Quick-Change Chucks — *Special* Multiple Operation Tools

General Electric Tachometer Checks Speeds to 50,000 rpm.



An electronic tachometer designed for measuring rotating speeds from 300 to 50,000 rpm., is announced by Special Products Div., General Electric Co., Schenectady, N. Y. The unit weighs 19 lb., and is intended for production testing of equipment without permanent attachment.

The tachometer consists of a small pick-up head, six feet of flexible cable, and a measuring unit. Each pick-up head consists of a light-interrupting disk and a phototube. Light shining on the phototube through the openings in the rotating disk produces input signals which are sent to the measuring unit.

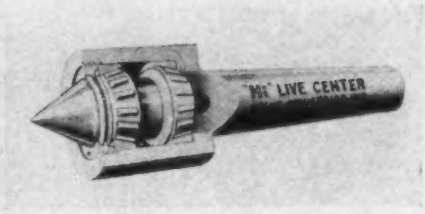


ALUMINUM HEAT-TREATING—Batch-type furnace for heat-treating aluminum alloys has an atmospheric-type burner mounted on the lower end of the duct used for recirculating the air back into the furnace. A Garden City high-temperature fan is used to recirculate the heated air. It is made by Bellevue Industrial Furnace Co., 2917 Bellevue, Detroit, Mich.

Holub Industries Live Center Has Preloaded Roller Bearings

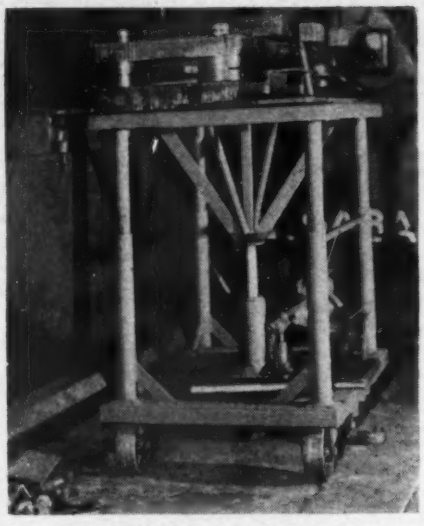
A line of "Hi" live centers is announced by Holub Industries, Inc., Sycamore, Ill. The centers are equipped with matched and preloaded Timken bearings.

Eccentricity or run-out of the point is held to 0.0002 in., both free and under load. The centers will carry loads up to 1,000 lb. in the No. 2 and 3 Morse Taper sizes, and up to 2,400

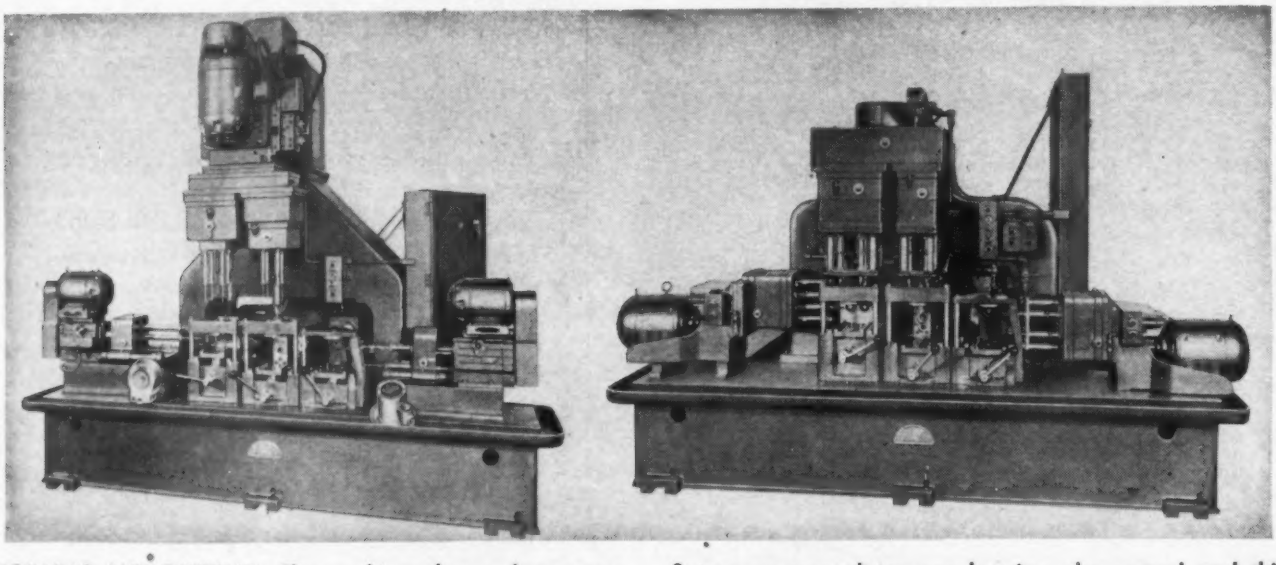


lb. in the No. 4 and No. 5 Morse Taper sizes. A grease seal is included which is said to prevent entrance of dirt and reduce internal wear.

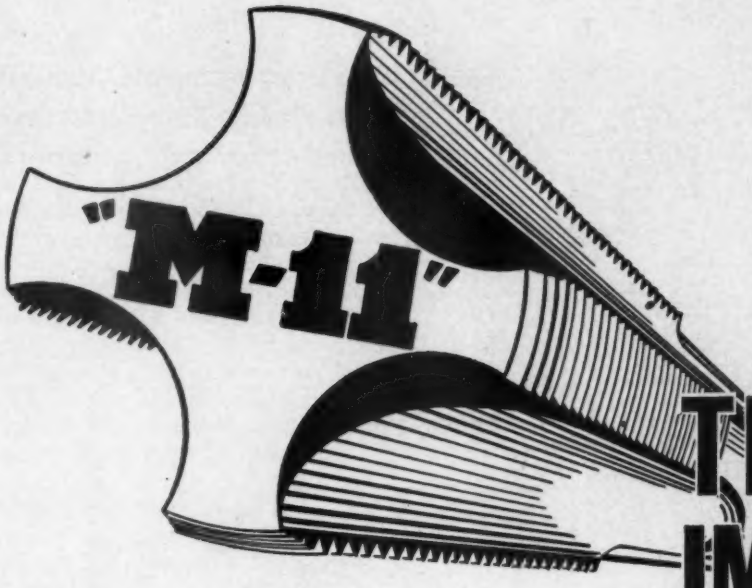
Rack Engineering's Utility Table Is Rated at 2000 lb. Capacity



A hydraulic utility table, Model No. 11067, is produced by the Rack Engineering Co., 5102 Butler St., Pittsburgh 1, Pa. Rated at 2,000 lb. ca-



DRILLING AND TAPPING—The machines shown above were designed and built by Snyder Tool and Engineering, 3400 East Lafayette, Detroit 7, Mich., for drilling and tapping two separate pump housings. On each machine, the first fixture accommodates one housing, the second and third fixtures take another housing in two positions. Multiple heads are designed in individual spindle groups to permit changes in product design



THE MOST IMPORTANT TAP NEWS IN 25 YEARS

"M-11" is an *exclusive* chrome-cobalt high speed steel, especially developed for Detroit taps. It provides four outstanding exclusive tapping advantages:

Higher abrasion resistance—less wear; longer tap life

Higher toughness with hardness—less chance of tooth breakage; less tooth chipping of the cutting edge

Higher red hardness—ability to tap efficiently at drill speeds or even higher

Higher torsional strength—greater resistance to twisting and breakage.

These are not idle claims. They are backed up by the performance, in all kinds of service, of hundreds of thousands of "M-11" taps produced prior to this announcement.

Typical is the statement of the Tool Engineer of one of the largest of metal working plants, that his organization has been unable to find any tap to match the "M-11" in performance.

"Of course", he says, "you have to give some of the credit to the kind of tool engineering and accuracy that Detroit Tap puts into its tools. But if you add 'M-11' on top of that—you really have something!"

If you have not yet tried "M-11" taps, you have an eye-opener coming. They are now available at no extra cost—from stock—in practically all standard and many special sizes. Try them on your toughest jobs, if you wish. A complete catalog is available on request.

Request the visit of one of our service men. There is one in your area.
Write, wire, or phone today.

GROUND TAPS
•
THREAD MILLING CUTTERS
•
THREAD GAGES AND SPECIAL THREADING TOOLS, MACHINES AND CHECKERS

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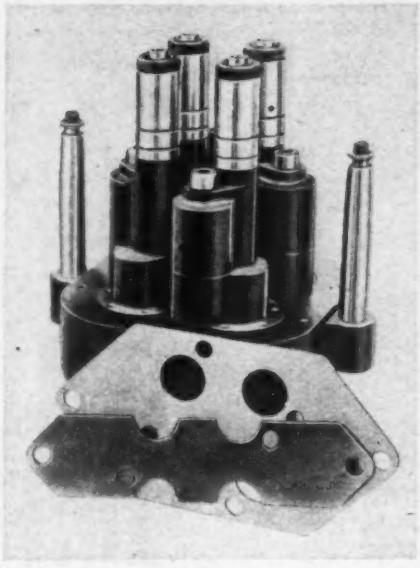
•
"M-11" IS USED ALSO IN ALL OF DETROIT'S THREAD ROLLS, THREAD PLUG GAGES AND THREAD MILLING CUTTERS

pacity, the table is mounted on heavy-duty, roller-bearing casters. A foot-operated floor lock anchors the table to the job. The load is raised by a pedal, leaving the operator's hand free during lifting.

Wisconsin Adjustable Drillhead Built with Two to Six Spindles

An adjustable drillhead in which each drill revolves completely around two different centers, each of which has a 15/16-in. radius is built by Wisconsin Drill Head Co., Ltd., and distributed by Strutz & Mead Co., Inc., 1225 N. Water St., Milwaukee 2, Wis.

Each drill point can be located and locked at any point in the area of a 3¾-in. circle. Each circle overlaps at least one other circle. A set of templets is furnished for each hole-pattern to be drilled. The positioning templet has half-holes to permit the spindles to be swung into position. The locking templet is then placed over the spindles and bolted to the support post. Individual spindle lock-nuts are tightened



to give double locking in position.

The drillhead is made in standard models with two to six spindles. It is entirely gear-driven and may be mounted on most standard drill presses without special tools. Minimum centers are 1⅛ in., and maximum bolt circles are 8¾ in. in diameter.

Dow-Gage Mechanical Comparator Is Used for Depth Measurement

A method for internal length comparison is announced by Dow Mechanical Corporation, Thompsonville, Conn. The Dow-Gage is a mechanical comparator incorporating a standard dial indicator. The indicator is actuated from a specially engineered test platen or stage at the front of the gage.

The work to be checked is placed over a pin on the stage and the depth measurement is made by movement of the pin.

A zero reading on the indicator is first obtained by placing a master or approved first piece on the gage and adjusting for zero setting. The Dow-Gage then serves to compare production-run pieces with the first piece. Merely placing the part upon the stage causes the indicator to register the depth measurement.

Stages are developed from a standard base so that a single gage can be fitted with a series of stages for a variety of functions. Stages and pins not in use may be stocked in a standard manner. A suitable gage for short-run jobs may often be provided by merely grinding a pin to the desired length.

The Dow Mechanical Service designs and manufactures stages and pins to fit requirements. A basic elevation drawing form is provided to facilitate rapid detailing of stages and pins required.

LIFT-TRUCK—Pneumatic tires on this 4,000 lb., fork-type lift truck adapt it for use over indoor or outdoor road surfaces. Made by the Hyster Co., Portland 8, Oregon, it uses a Wisconsin air-cooled motor and has trunnion steering

Needle Bearings can Boost Production, too!

One good way to give your production a lift is to simplify design problems and assembly operations through the use of Torrington Needle Bearings.

The compact unit construction of these modern anti-friction bearings speeds progress at every stage . . . from design to final installation. Needle Bearings require only a bore machined to proper dimensions for the housing . . . installation is a simple press fit operation . . . no retainers or spacers are necessary to hold them in position. Thus, there are fewer production and assembly steps, fewer parts to handle and control when Needle Bearings are employed.

Torrington Needle Bearings also help to improve product performance. Their high radial capacity and compact design saves space and weight, and their efficient lubrication means better operation, less maintenance, and less time out for servicing or overhauling. So, production is aided in this way too—by keeping tools, machinery and handling equipment on the job.

Let our engineering department show how you can boost *both your production and your product's efficiency* through these and other Needle Bearing advantages. Write for our informative Catalog No. 32.

THE TORRINGTON COMPANY
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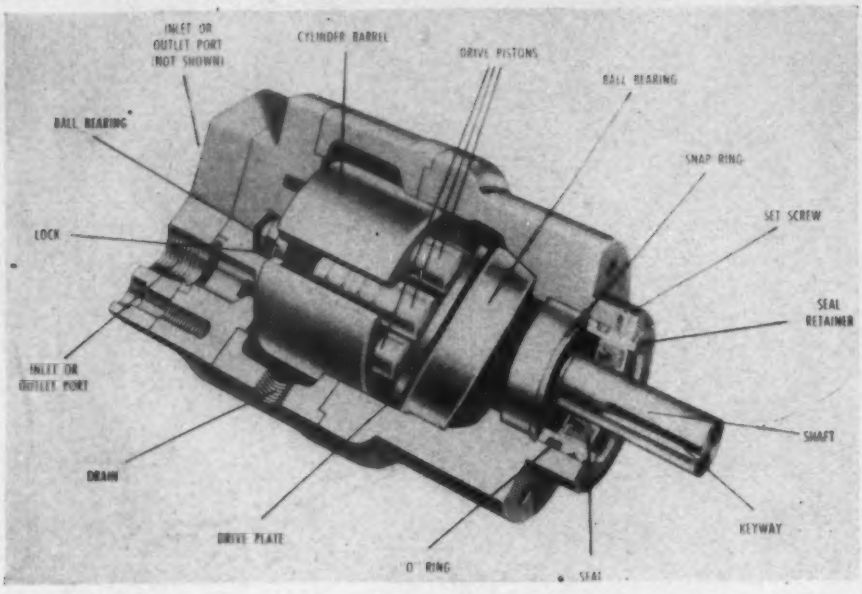
TORRINGTON NEEDLE BEARINGS

Parts and Materials

Axial-piston Design Fluid Motor is Built by Denison Engineering



A fluid motor for controlled variable speed where shock-loads present problems, is announced by the Denison Engineering Co., Columbus 16, Ohio. The motor is available in a 3 or 5 hp. capacity, with or without a speed-control valve. A choice of geared-head units of various gear ratios and of brackets for mounting the motor in difficult positions is available.

The motor is of axial piston design with constant pressure contact maintained between the driving and driven elements without the use of mechanical linkages. The motor is self-starting and will operate in either direction.

When equipped with speed-control valves the motor can be preset to operate at any speed within its capacity. The plunger device permits instant acceleration from any preset speed to full speed to meet rapid traverse requirements. When the plunger is released, the motor returns to preset speed.

When the motor is used without a speed-control valve and is powered by an independent pumping unit, the speed can be regulated by adjusting the volume of oil.

Rogers Laboratory Cutting Oil Is for Drills, Taps, and Dies

A product called Miracle Fluid for lubricating drills, taps, dies and reamers, is announced by the Rogers Laboratory, 257 Wooster St., New Haven, Conn. The material is said to prevent burning of cutting tools, and to be non-inflammable, non-explosive, and non-toxic.

American Metal Hose Conduit Designed for Machine Tool Use

An electrical conduit for use on machine tools, is announced by the American Metal Hose Branch, The American Brass Co., Waterbury 88, Conn. Developed to exclude moisture and oil from the electrical wiring on machines, the conduit meets the requirements of the National Machine Tool Builders Association.

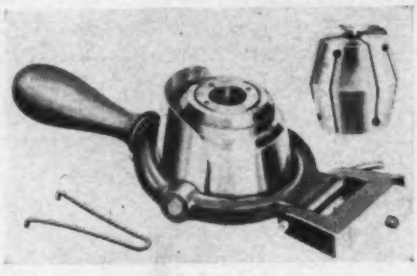
Sealtite conduit is made of a galvanized steel flexible tubing covered with an oil-proof synthetic material. The conduit fittings are standard pipe thread, and may be had either permanently attached at the factory, or reattachable for assembly on the job.

Tube Turns Welding Fittings Are Made of Stainless Steel

A line of stainless-steel welding fittings is announced by Tube Turns (Inc.), Louisville, Ky. The line includes 180° long radius returns, 90° long radius elbows, 45° long radius elbows, straight tees, reducing outlet tees, caps, eccentric reducers, concentric reducers, lap joint stub ends, laterals and crosses, all in standard and extra heavy weights. A variety of flanges are also included.

The fittings are available in three grades of stainless steel: Type 304, 18% chromium and 8% nickel; type 347, 18% chromium, 8% nickel, and approximately 1% columbian; type 316, 18% chromium, 8% nickel and 2% molybdenum.

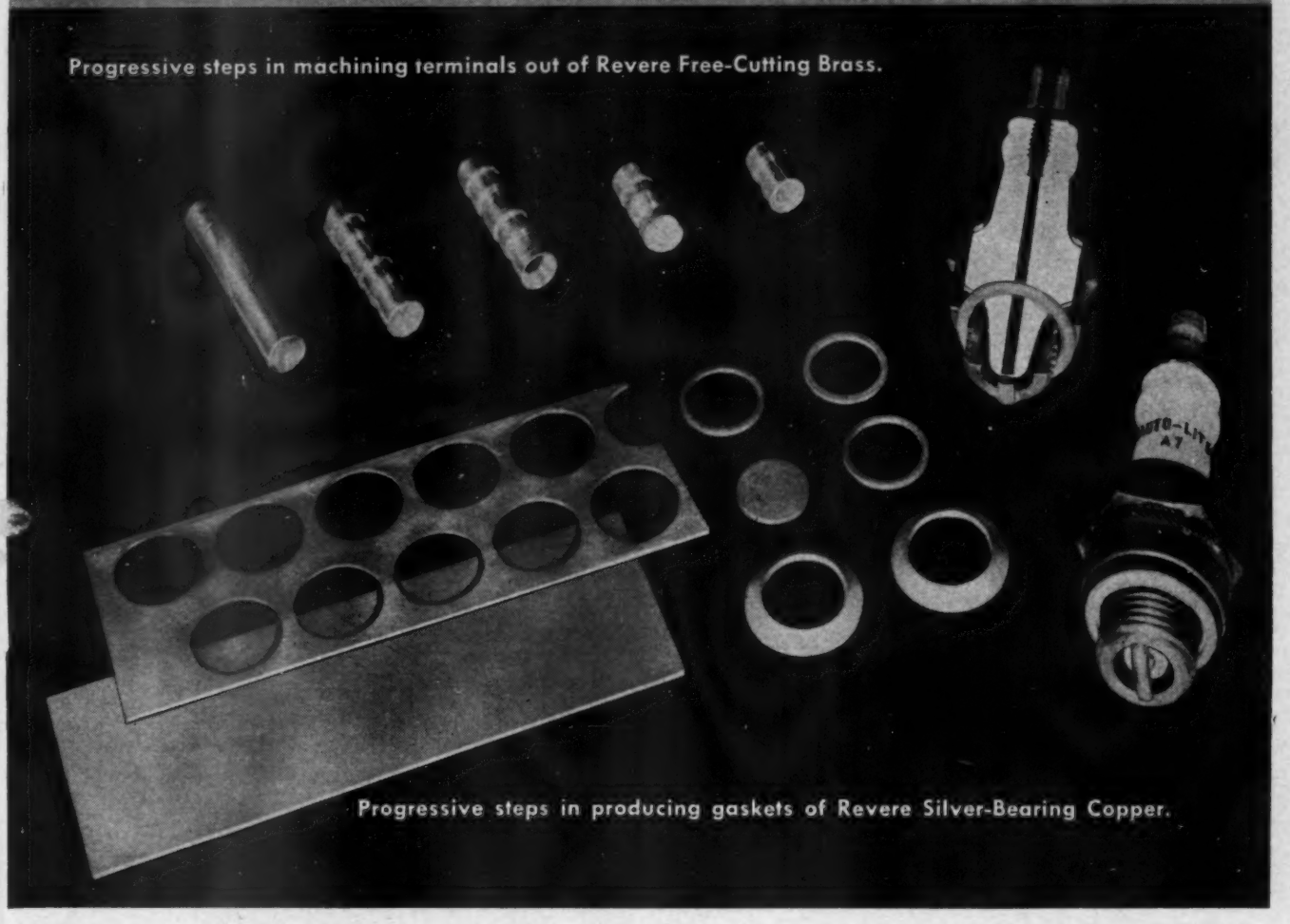
Micro Parts Collet Chuck Adapted to Bench Lathes



A collet chuck adaptable to standard bench lathes is produced by Micro Parts Co., Dept. AM, 322½ East Beach Ave., Inglewood, Calif. Called the Miracle Collet Chuck, it can be used with stock up to 1 in.

The chuck extends 1½ in. beyond the spindle nose of the lathe. Collets are available in rounds, squares, and hexagons for use in the chuck. The entire unit revolves on the spindle and there are said to be no parts which require lubrication.

SPARK PLUG ILLUSTRATES VALUE OF CAREFUL SELECTION AMONG REVERE METALS


Progressive steps in machining terminals out of Revere Free-Cutting Brass.
Progressive steps in producing gaskets of Revere Silver-Bearing Copper.

THE automobile industry, an important Revere customer, is noted for the extreme care it uses in selecting among the many Revere Metals. This careful selection assures speed and economy in manufacture, and protects reliability of operation in the hands of the ultimate user.

Take, for example, the Auto-Lite Spark Plug. The terminals are made by the millions in automatic screw machines. The stock is Revere Free-Cutting Brass, which permits high turning speeds, accurate threads, and a fine finish.

Gaskets, three to each plug, are punched and formed out of Revere Silver-Bearing Copper. This metal was chosen in order to prevent annealing during operation, thus retaining the spring tension which is necessary to prevent leakage or "blow-by" past the gaskets.

Revere Metals include: *Copper and Copper Alloys:* Sheet and Plate, Roll and Strip, Rod and Bar, Tube and Pipe, Extruded Shapes, Forgings; *Aluminum Alloys:* Tube, Extruded Shapes, Forgings; *Magnesium Alloys:* Sheet and Plate, Rod and Bar, Tube, Extruded Shapes, Forgings; *Steel:* Electric Welded Steel Tube.

Perhaps your product could benefit by a careful study of the varied forms, qualities and characteristics of the Revere Metals. The Revere Technical Advisory Service will gladly cooperate with you.

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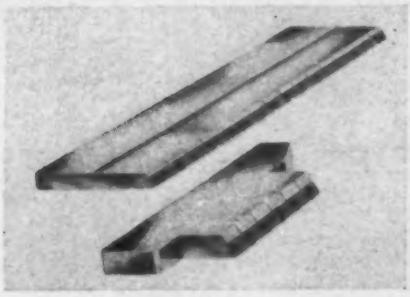
Scully-Jones Work-rest Blades Have Carbide Tip in Segments



A carbide-tipped, work-rest blade of segmented design has been developed by Scully-Jones & Co., 1901 S. Rockwell St., Chicago, Ill.

Damage to one or more of the segments does not require scrapping of the blade, since it can be returned to the factory and the damaged segments replaced at low cost. This design is also said to make possible the use of a harder, longer-wearing grade of carbide.

The segment slots are self-cleaning, being designed so that metal chips are carried away by the circulation of the coolant. Slots are said not to mar or score the softest metals.

Ampco Copper-tungsten Alloys Made for High Heat, Pressure

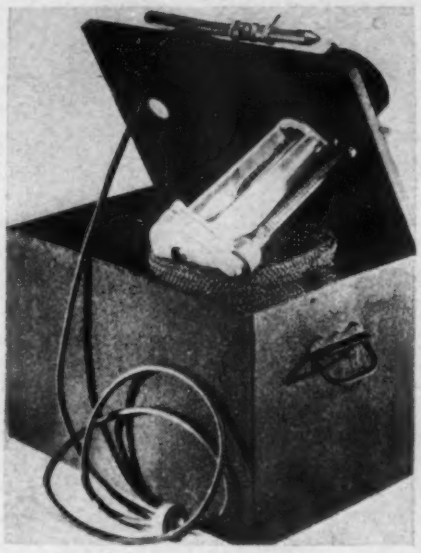
A line of copper-tungsten alloys, in the form of rods, bars, and inserts, is announced by Ampco Metal, Inc., Milwaukee 4, Wis. Main applications of the alloys are in projection and flash welding, die facing and inserts, electrical upsetting and forging dies, and similar applications. The alloy is suitable for use where electrodes are held over a fairly long period at high heat and pressures, or where water cooling is not available.

Two silver tungsten alloys are being produced in rods, bars, and inserts for applications such as circuit breaker contact material and arcing tips.

Coolant Filtering System Uses a 7-gal. Steel Tank

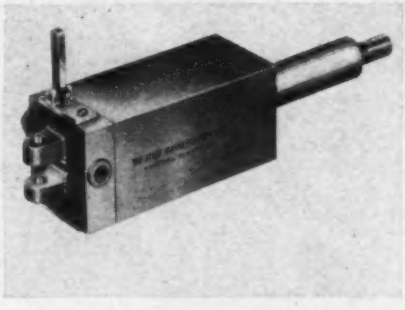
A self-contained filtering system to remove metallic particles from coolant, is announced by Inject-A-Flow Pump Co., 67 N. Willow St., Montclair, N. J.

The system is said to be adaptable to any machine tool, including grinders. The strainer is said to exclude fine particles without creating back pressure that would reduce the flow



of coolant. A 7-gal. rectangular steel tank contains a Strainco strainer unit. The pump unit is mounted on the lid of the tank with the pump operating inside the strainer unit.

Fenn Custom-built Air Cylinders Are Single-, Double-acting Type



Air cylinders are now being custom-built by the Fenn Manufacturing Co., Hartford, Conn. These cylinders are designed and built to fit the customer's machine design.

All unnecessary packing is said to be eliminated, reducing friction loss and maintenance cost. The cylinders can be cushioned at either or both ends of the stroke. The cylinder valve can be furnished as a separate item, or as an integral part of the cylinder.

The cylinders are furnished in single-acting, double-acting, and differential-acting type.

DuBois Coating for Paint Booths Forms Skin Which Is Peeled Off

A fluid compound which is sprayed or brushed on the walls of paint spray booths is produced by the DuBois Co., Cincinnati 3, Ohio. Known as "Filmite," it forms a tough skin over a non-hardening base which catches and holds the overspray. The material with adhering overspray is peeled off the walls. The material is water soluble and can be washed off if desired.

Bayflex Raised-hub Disks Can be Used for Cutting Off

Bayflex raised-hub disk wheels are announced by Bay State Abrasive Products Co., Westboro, Mass. They are said to outwear abrasive-coated disks and to be applicable for grinding and cutting off.

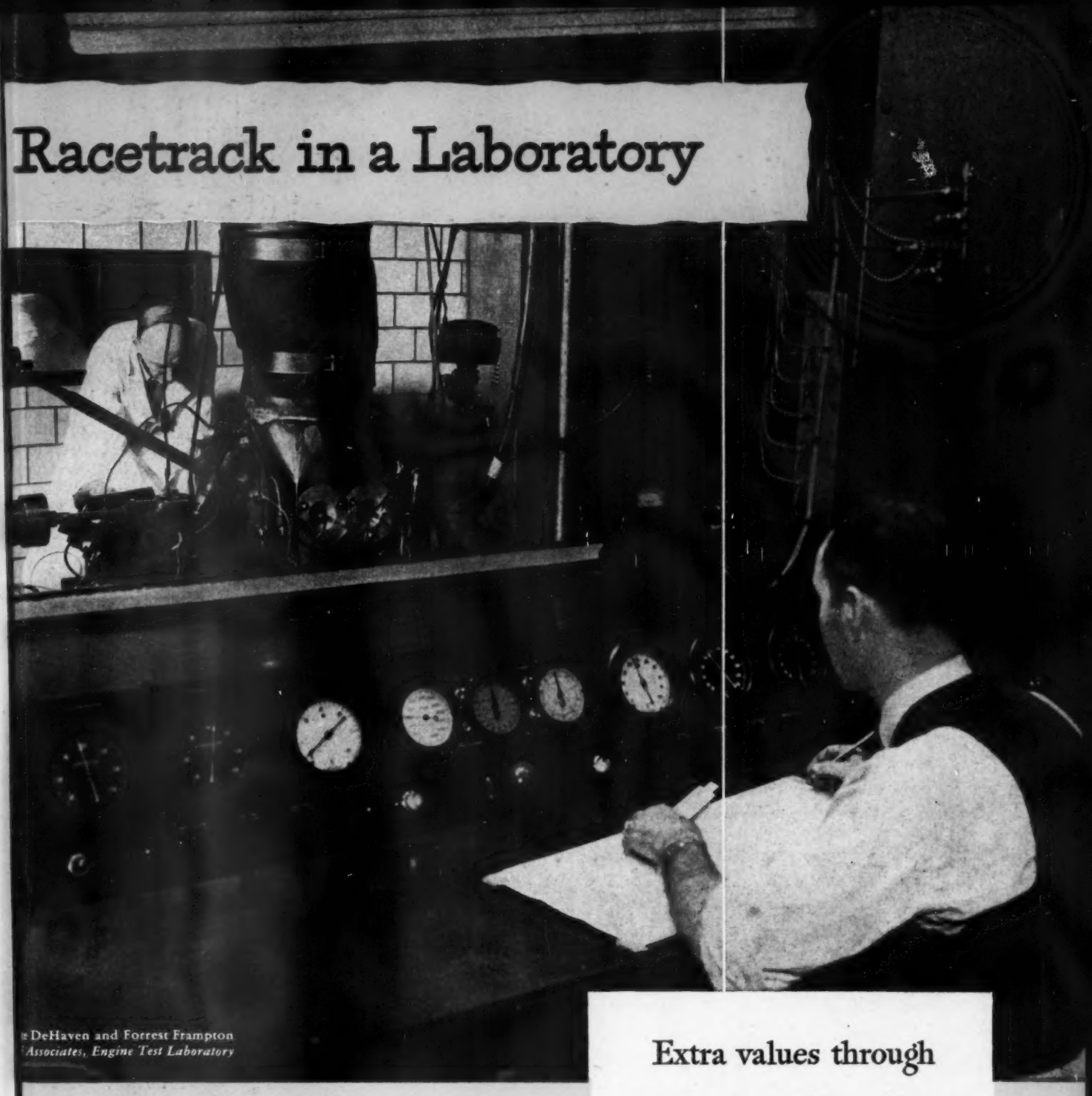
The disks are applicable for work on welded or brazed metals and grinding aluminum castings. The disks are said to be usable down to the nut and not to be subject to "loading" under normal conditions. If the wheel does become loaded it can be cleaned by touching the face on a concrete floor.

Tinnerman New Speed Nut Line Is Heat-treated Spring Steel

A line of heat-treated, spring-steel speed nuts is announced by Tinnerman Products, Inc., 2113 Fulton Road, Cleveland 13, Ohio. Known as the C-7000 Series, it includes sizes to fit the ten most popular sizes of machine screws and sheet metal screws.

The new speed nuts are said to be more compact, withstand higher torque tightening, and provide greater tensile strength than previous models.

Racetrack in a Laboratory



e DeHaven and Forrest Frampton
Associates, Engine Test Laboratory

Extra values through

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Mass Precision

You are looking into one of the "torture chambers" of our engine laboratory where the world's largest pressure-die-cast, four-cycle engine is going through its paces. Under sustained tests this new Jack & Heintz slide-valve engine reveals exceptional fuel economy. Its weight is far less than that of conventional automobile engines. It is more efficient and has a much wider speed range.

This new engine is typical of Jack & Heintz achievements through *mass precision.* This rare combination of high precision and mass production is creating better engines, electric motors, refrigeration compressors, aircraft accessories, bearings and magnetos *today,* and is developing other revolutionary products for *tomorrow.*

CK & HEINTZ PRECISION INDUSTRIES, INC., *Cleveland 1, Ohio*

How many wipes in a wiper?

here's why "KEX" WIPING TOWELS have hundreds of more wipes

One look at a KEX Industrial Wiping Towel tells you you're going to get greater performance. Just compare! Every square inch of a KEX Wiping Towel is usable wiping surface—no buttons, hooks, hard seams as with ordinary rags, no loose threads to catch in machinery. KEX Wiping Towels are soft and safe for delicate surfaces—yet tough enough for any job in the shop.

Every KEX Wiping Towel is uniform in size—easier to distribute and keep track of . . . uniform and BIG enough for any wiping job in the plant. And KEX Industrial Wiping Towels are always on hand—delivered as often as necessary—cleaned by a *special* high-heat process. No need for huge piles of inflammables taking up valuable space, creating a fire hazard.

Rent KEX Wiping Towels and Figure Your Profits

Why put up with the inefficiencies of sub-standard wiping materials another day? Install the KEX Wiping Towel system today, improve performance and *save* on wiping costs. There's nothing to buy, no expensive inventory—just a low monthly rental. For complete information, phone your local KEX representative, now—or write KEX National Service, 295 Fifth Avenue, New York 16, N. Y.

"KEX" NATIONAL SERVICE

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"KEX" REG. U.S. PAT. OFF. NATIONAL SERVICE A CALLAWAY MILLS PRODUCT INDUSTRIAL WIPING CLOTHS

ROUND TABLE *Discussion*

HOW MUCH SHOULD MEN BE TOLD?

Some information should be given employees without going too deeply into the analysis of costs. For instance, weekly figures could be given of total production of various parts, with an aside figure of cost per individual part. The prime mover in the fluctuations of the cost figure would be rejects, and operators, knowing this, would take greater pains to keep this cost figure stabilized. The total-parts figure would give all a warning if production were slipping back.

Simple arithmetic would give the operator the difference between his "price per piece" and works' cost per piece, bringing home the fact that a business costs money to run. Giving detailed analysis of the make-up of this difference would provoke more than enough unprofitable discussion on items, for the most part, quite beyond the ken of the average operator, and leave openings for the shop's "sea lawyer" to cast reflections on the necessity of salesmen, office staff, etc., and other "non-productives."

Bulletin boards, yes! But for the display of that matter directly relative to the shop concerned, including of course, extracts from complimentary letters from consumers. Consumers adverse comments are not, and should not be, the fault of the shop, remembering always inspection, packing and delivery, consumer sales research, etc., each have their part to play.

W. J. Snook
Harrow, England

•

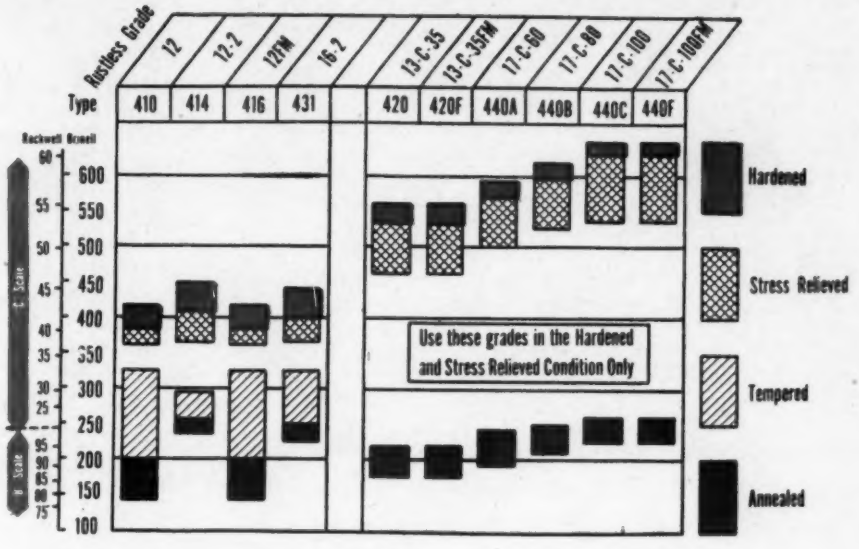
Knowing and bringing home to the men a realization of the cost of materials is a subject about which too much cannot be said. It is an absolute misfortune that competitive methods prohibit manufacturing companies from publishing prices of machines and materials in advertising pages of various trade journals.

Workmen depend on "interest in work" for motive power, just as the locomotive depends on steam. Too little is thought of the importance of men and their mental processes. But the need for cooperation of manpower is imperative. No business is so big that it can afford to ignore the cooperation of its workers, for, be-

RUSTLESS DATA SHEET NO. 8

Corrosion Resistance Plus Hardness By Heat Treatment

One of the Many Combinations of Properties Offered by Stainless Steels



THERE are 29 standard grades of stainless steels ... some are hardenable by heat treatment ... some contain nickel ... all contain chromium. This variation in composition and response to heat treatment divides them naturally into three distinct groups.

Group I ... Chromium. Hardenable by heat-treatment.

Group II ... Chromium. Hardenable slightly by cold work only.

Group III ... Chromium-nickel. Hardenable only by cold work.

Stainless steels included in Group I are the only grades which respond to hardening by quenching, stress relieving and tempering operations in a manner similar to carbon and low alloy steels. The most commonly used Group I grades and their response to heat treatment is shown on the above chart. Highest hardness is developed with Type 440C which is used for applications requiring wear resistance, such as balls and ball bearing races. Type 440F, the free-machining counterpart of Type 440C, is used for valves and other parts requiring extreme hardness plus good machinability. Types 420, 440A and 440B develop hardness values ranging from a minimum of 450 Brinell for Type 420 to a maximum of 600 Brinell for Type 440B. They are used for products such as surgical instruments, valve seats, cams and carving knives. Type 420F is the free-machining counterpart of Type 420. Types 410, 414, 431 contain less carbon, develop slightly less hardness, but provide greater protection against corrosion, particularly Type 431 which has the best corrosion resistance of any in this group. In general, corrosion resistance increases with the chromium content and decreases as carbon content rises. The lower carbon grades are used extensively for turbine blades, cold-headed screws, bolts, pistons, pump rods and many other products. Type 416 is the free-machining counterpart of Type 410. It is widely used for high speed machining operations on automatic equipment.

Hardening the Group I alloys is accomplished by heating above the critical or transformation temperature and rapidly cooling in air or oil. Water quenching is not a good practice and is likely to produce quench cracks, especially with the high carbon grades. Hardening should always be immediately followed by a low temperature treatment (300°-700°F.) to relieve stresses developed in quenching, particularly the high carbon grades. A wide range of tensile and hardness properties can be secured by tempering Types 410, 414, 416 and 431. The higher carbon types should be used only in the hardened and stress relieved conditions because of the adverse effect tempering has on their corrosion resistance. When you want to know more about the heat-treatment of stainless steels, consult Rustless Division of ARMCO.

For complete information on the heat treatment of all stainless grades, request a copy of Rustless' comprehensive and widely read 58 page book "Heat Treatment of Stainless Steels". If you merely need handy reference charts on some particular grade – for use under your desk top or in the shop—send for copies of Rustless' "Heat Treatment Data Sheets".

Rustless

DIVISION OF ARMCO

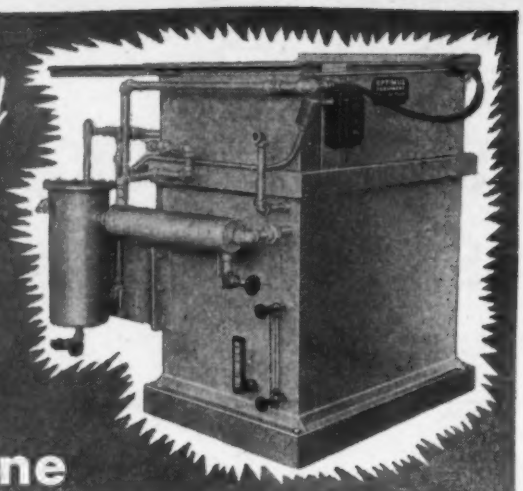
RUSTLESS IRON AND STEEL DIVISION

THE AMERICAN ROLLING MILL COMPANY

Baltimore 13, Maryland

STAINLESS STEEL SPECIALISTS

Announcing



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Type OP-1-40 OPTIMUS Vapor-Spray Type Degreaser. Designed for use with trichlorethylene. Installed to degrease metal parts prior to plating. All parts of unit hot galvanized after fabrication. Heating and cooling coils readily removed. Unit acts as a still to recover salvaged solvent. One of a series of standard OPTIMUS models.

To adequately round out and complete its line of Metal Cleaning and Drying Equipment, the Optimus Equipment Company announces the manufacture and marketing of a full line of Metal Parts Degreasers.

This new equipment, which has been carefully engineered to include the latest developments in the field of vapor degreasing, will cover a wide range of applications. Equipment will be available embodying a varied number of cleaning cycles, including Vapor, Vapor-Spray, Liquid-Liquid-Vapor, Liquid-Vapor, as well as combinations of these and the use of supplementary pump and spray washing facilities, to meet special requirements. Investigate the production savings which vapor degreasing may make possible in your metal finishing operations. Let OPTIMUS engineers submit an equipment plan specially designed to fit your needs, embodying the use of standard or special models.

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STANDARD AND SPECIAL TYPES OF EQUIPMENT FROM THE SMALLEST TO THE LARGEST SIZES FOR A WIDE VARIETY OF OPERATIONS.

OPTIMUS EQUIPMENT
FOR CLEANING · RINSING · DEGREASING · PICKLING AND DRYING OF METAL PARTS

tween negative indifference and positive cooperation, as attitudes of mind, lie a difference in efficiency that may easily make the difference between a handsome profit and a heavy loss.

How many works managers and managing directors realize what profits they miss by failing to give credit where credit is due, by failing to give encouragement where encouragement is due, by failing to give thanks where thanks are due? These things cost absolutely nothing, yet in some industrial concerns one would think they would cause an overdraft at the bank if they were indulged in, so conspicuous are they by their absence.

Errors in machinnig are always costly. When a machine part or an automotive component is spoiled through a mistake in the shop, the loss involves not only the time of the machinist who made the mistake, but of the men who performed previous operations on the piece. Sometimes the material scrapped because of a mistake is of greater value than the labor cost; and the overhead costs may be distributed over spoiled as well as perfect work.

A workman's sense of responsibility is increased by calling his attention to the actual money value of a mistake he has made, and some plants have been able to decrease the amount of spoiled work by recording and issuing to the men a detailed statement of the cost to the company of their mistakes.

In the toolroom especially, and when working on large forgings or castings, the cost of mistakes may run into very high figures. A slight error on the part of a toolmaker may spoil a die on which a considerable amount of machining work has been done.

There is little doubt in my mind that it is both practical and profitable for companies to let their employees have 100% knowledge of the cost picture.

A. Eyles
St. Albans
Hertfordshire, England

•

If an employer has anything to hide, the less information he discloses about his business, the better. But the majority of employers have nothing to hide. They are using and risking their money for what often represents a meagre return. If the man in the shop realized the risks behind the 10% profit per year secured by some firms as a result of a year's trading, they would be astounded.

For example, would the average employee let someone use $100 of

Gaging WITHOUT CONTACT

At a Speed as Fast as Light!

Hot sheets or strips of metal or foil flying from the rolls; paper emerging in a never-ending sheet; or the plastic or rubber blanket flowing from a calender, may be checked instantly for thickness, and this thickness controlled during the process, by the Sheffield Measuray.

Temperature of the material to be checked and its speed of movement do not affect the accuracy of the thickness check. Proximity of gaging head to material is not important—it can be as much as a foot or more distant, depending upon the application. Amplification and sensitivity are available in excess of any known industrial requirements without sacrifice in speed, range, or dependability. For instance, it is possible to amplify one per cent of the thickness of the stock being checked to extend over the full scale range.

The Measuray may be mounted on a production machine, or it may be used at the bench to measure stationary objects, especially those whose surfaces might be marred by a contact gage, or those of such resiliency that the contact gage measurements are not practicable.

See the Measuray demonstrated at the Sheffield plant in Dayton. Bring samples of work to be checked to see for yourself the savings in material and time, elimination of losses in destructive testing, and the increase in uniform quality which the Sheffield Measuray can bring you.

If a visit is not convenient, write us for detailed information. For an early installation, ask for a survey to be made in your plant by Sheffield engineers—no obligation on your part.

Write to Department B

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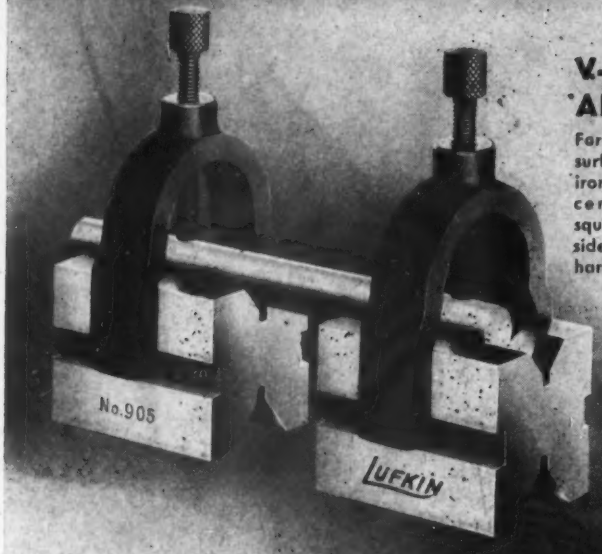
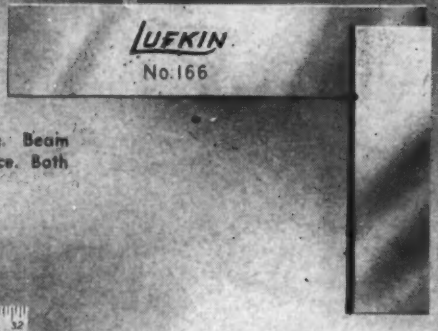
FOR PARTICULAR WORK



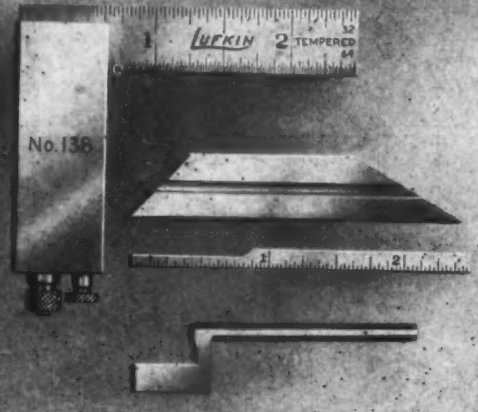
V-BLOCKS AND CLAMPS

For laying out work with surface plate or angle iron. The V's are ground central, parallel and square with the ends and sides. Made of tool steel, hardened and ground.



HARDENED, SOLID STEEL SQUARE

A master square for accurate checking. Beam is solid, being constructed in one piece. Both beam and blade are lapped.



DIEMAKERS SQUARE

Blades slide in the head and can also be adjusted at an angle with the stock. Heads hardened and ground. Available with Standard, Bevel, Narrow and Offset Blades.

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his money for a whole year on the chance, not certainty, of getting an extra $10 back? I doubt it.

For that meagre 10% profit, the company has to buy material, get it machined and stand the risk of spoilage. If the work takes longer than estimated, say 66 min. instead of 60 min., the profit goes out the window. In addition, the employer must seek orders, must take the risk of making goods for stock when business is bad because the "Ed's" referred to in the Round Table must have their weekly dough regularly.

The question should not be "How much should men be told," but rather "Why should facts or information be withheld which would enable workers to see how important it is for them to pull their own weight?" Profits, as shown in balance sheets, look impressive, but if they were apportioned over the money expended—for wages, materials, etc.—a very different impression would be obtained.

No, the average employer has nothing to hide, excepting, perhaps, he is working under price, he takes too many risks, his results are too hazardous. More power to Al for getting all the help from the front office to expplain overhead costs and how they are made up. Tell the employees more about the overall company functions and maybe their understanding will result in more conscientious endeavor.

J. Ellward
Bexley, England

•

EQUAL PAY FOR EQUAL WORK? The recent discussion, "Equal Pay for Equal Work?" presumes that wages are paid only for work produced. Actually, this is not the case, since many factors are involved in establishing a wage rate paid to a worker.

However, two of the most important factors involved are the quantity, and quality of work produced and the type of work being performed. To determine which of these is the more important, other factors must be considered, including cooperation, the absence of which causes a group or a department to be in turmoil constantly; judgment, which allows a man to make many decisions for himself without constant supervision; initiative, a valuable asset, which causes men to try something new in search of a better method; confidence, which comes from the ability and training to properly perform the job assigned; and future potential value to the company, which factor, in the case

VICKERS HYDRAULIC·CONTROL

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Important advantages of Vickers hydraulic controls that make for higher production rates and greater versatility are illustrated by this Etna Hydraulic Tube Cutoff Machine. Completely automatic is the cycle which feeds the tubing rapidly and accurately to length within a few thousandths, provides quick action clamping, cuts off and then unclamps the stock. Feeding and clamping rates are varied by simply turning a dial . . . there are no cams or gears to change. The rapid traverse approach of tool slides and the rapid return save time. The machine is compact and completely self-contained; it is changed from one diameter of tube to another in a few minutes.

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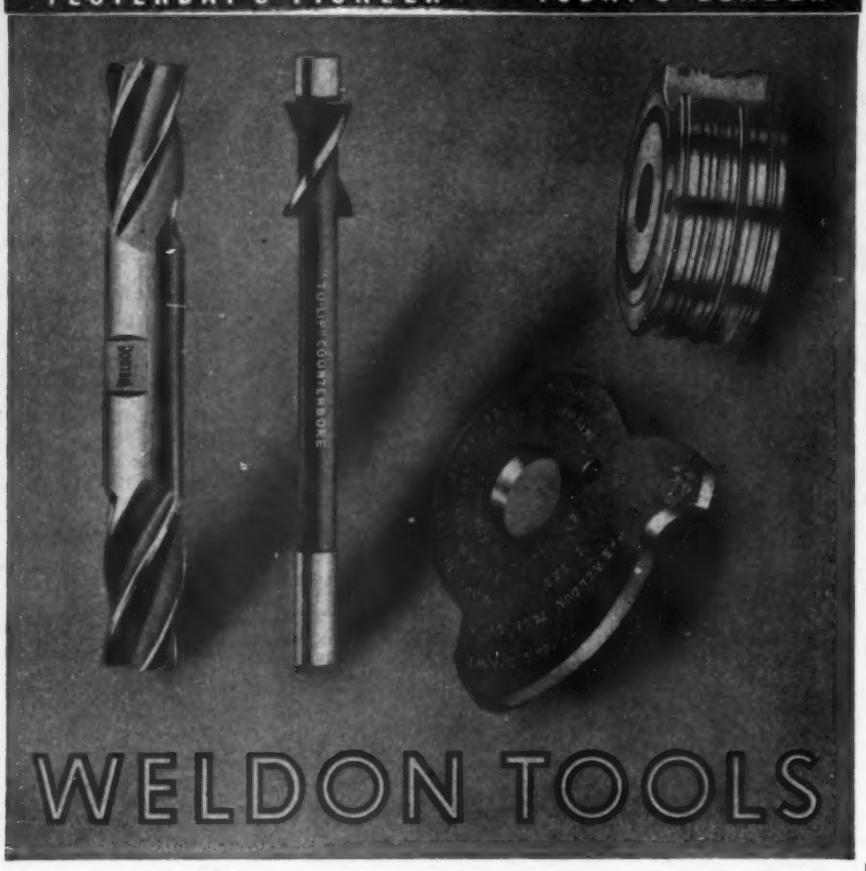
YESTERDAY'S PIONEER • • • TODAY'S LEADER



They take it in their Stride

WELDON Tools are built for tough going. Where production requirements call for a combination of high speed and fast feed with heavy strain *WELDON Tools take it in their stride.*

The secret is in their special design, high quality material, fine workmanship and rigid inspection.

Let us help you on your cutting tool problems.

WRITE FOR CATALOG 8-B

THE WELDON TOOL CO. Cleveland 4, Ohio

3000 WOODHILL ROAD

of Henry Mack, was glaringly absent. Many other factors are involved but these are sufficient to illustrate the importance of their consideration.

Workers as a rule possess these characteristics in varying degrees. Some may produce a large quantity but a poor quality of work, others may be cooperative but may lack judgment or confidence. The presence or absence of these factors is sometimes beyond their control but the foreman, who makes a study of his men and learns their virtues and shortcomings, can keep his department functioning smoothly and efficiently by selecting the proper man for the right job, by weighing the factors most important for the job at hand, and making certain that all his men are compensated, according to their over-all value to the company.

Robert Knotek,
University Hts. 21, Ohio.

SEEN and HEARD

BY JOHN R. GODFREY

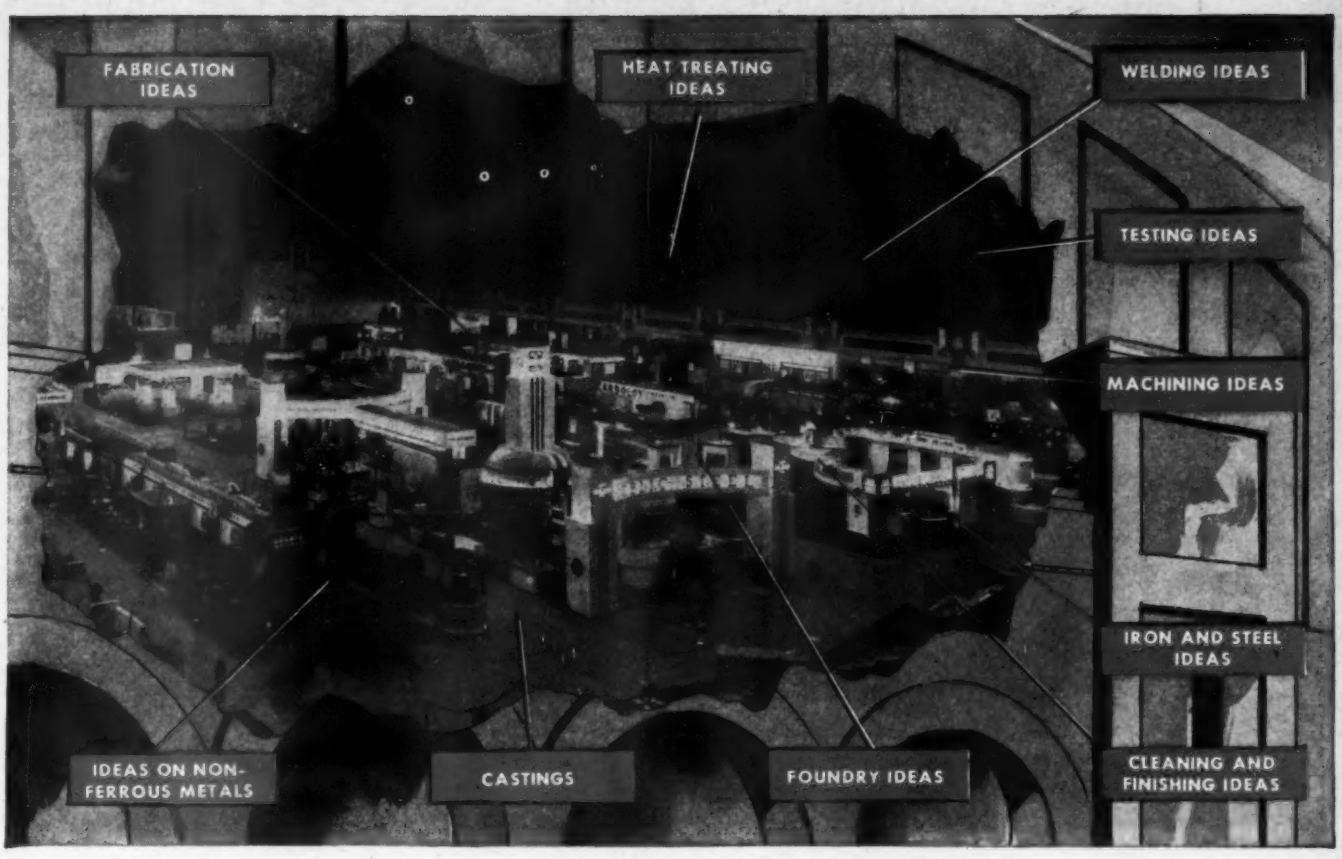
Reviving Old Practice

ANOTHER REVIVAL of old practice is that of a positive lead in tapping threads. It's a grand idea in every way. The first use I recall was in cutting the threads on staybolts with a lead screw to guide the work and the die, by the Acme Machinery Company in Cleveland. This was done particularly for threading staybolts for locomotive boilers. The distance between the firebox sheet and the outer shell is sometimes very long, and off-lead staybolts put unnecessary stresses on both the boiler sheets and on the staybolt itself. The advantages of this method were advertised just as guided tapping is today, and with good reason in both cases.

•

Is Streamlining Overdone?

DR. TRUEDSSEN'S comments on modern machine-tool design are to the point. While none of us want to go back to planers and punch presses with fluted columns or grapevine designs on the tie-piece of boring mills, socalled streamlining of stationary machines had disadvantages of its own. The smooth lines were more pleasing to the eye than Chippendale legs on sprue cutters and engine lathes but they have their drawbacks in the way of concealed motors and parts that are hard to



FIND THESE *PRODUCTION* IDEAS

AT THE METAL SHOW

MUNICIPAL AUDITORIUM, ATLANTIC CITY, NOVEMBER 18-22

We're taking the lid off to give you a glimpse of what awaits you at the big National Metal Congress and Exposition, Atlantic City Municipal Auditorium, November 18 - 22.

More than 300 of the nation's leading manufacturers are concentrating their latest equipment and processes — many in actual operation — in the vast Auditorium and Exhibit Hall. Here will be your convenient opportunity to see exhibits featuring metals and equipment and processes for their welding, forming, casting, cutting, machining, heat treating, cleaning, plating, testing and inspection.

Here you will hear the production ideas developed by other outstanding metal experts from all the United States and Canada. During daily sessions of the Metal Congress sponsored by four great national societies, you may discuss research papers developed by hundreds of outstanding authorities. More than 100 technical and practical papers will be presented, covering all phases of metal industry operations.

Spend all or part of the week of November 18 — to your own very good advantage — in Atlantic City. Find the production ideas you need at this big 28th Congress and Exposition. You may secure hotel accommodations by wiring the Housing Bureau, 16 Central Pier, Atlantic City.

NATIONAL METAL CONGRESS AND EXPOSITION

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The American Welding Society . . . The Iron and Steel and Institute of Metals Divisions of the American Institute of Mining and Metallurgical Engineers . . . American Industrial Radium and X-Ray Society.

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Abrasive Belt
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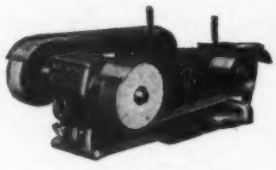
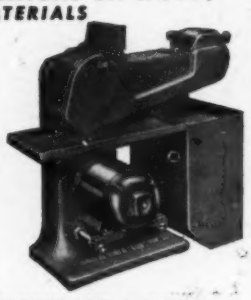
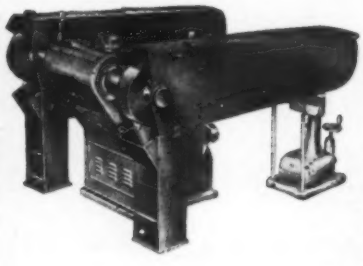
MODEL F-2 FLEXIBLE BELT — Especially suited for irregular shaped parts, eliminates costly hand filing.



MODEL NO. 5 DRI ONLY—UP TO 3" BELTS A popular hi-production grinding, polishing, buffing, deburring and brushing machine.



MODEL VH-6 WET-n-DRI, 6" BELTS — Vertical or Horizontal position. Other machines for up to 10" belts.



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Any speed from 1500 to 3000 RPM. Backstands can be purchased separately.

MODEL "400" WET-n-DRI, 4" BELTS Vertical or horizontal position. A popular belt grinder for finishing operations.

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10" WET and DRY CARBIDE TOOL GRINDER

No Spray — No Splash Guards, Safety Cup discs and heavy construction for fast, efficient grinding.

CARBIDE TOOL AND FINISHING GRINDER MODEL 7

For rough and finishing small tools and diamond wheel finishing of all size tools.

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"We invite you to visit our Booth A-138, National Metal Congress, Atlantic City, where this equipment will be in operation."

get at. And why we should "streamline" machines that never move has always been a mystery to me. The idea has its good points for airplanes, locomotives and automobiles, which are moving objects, but on machine tools the term is out of place.

•

Jap Machine Tools

ABE EINIG'S report on machine tools in Japan tallies with my own experience when I had the opportunity of visiting their shops before the war. They made remarkably close copies of some of our designs of milling and other machines. One tool and gage shop I visited was doing remarkably good work in a variety of lines. And some of the superchargers taken from captured Jap planes during the late war showed very good workmanship. The only sour note I found there was from some of the users of gear shapers who tried to use cutters made in their homeland without very good results. This was not surprising, when I recalled the extremely accurate methods that have been developed to make the gear shaper such a success.

•

Let's Avoid Confusion

NOMENCLATURE AND TERMINOLOGY are just a couple of hi-falutin' words for the names of things. But they are mighty important when you are wondering just what sort of a doohickey the user who wired you for a replacement part for a broken piece of his sausage stuffer really needed. We've done a lot in getting shop men to see the advantage of using names that mean the same in Boston as in Kalamazoo. But when we find some engineers using "lead" for what most of us call "feed" we still have work to do. The alibi is that lead means feed per revolution and feed may mean feed in inches per minute.

It seems to me that "lead" is so closely tied up with screw threads that it is better not to disturb it. Most of the researchers in metal cutting say "feed per revolution" if that is what they mean. If not, they assume that any one who knows machine practice would know that a feed of 0.025 in. would mean "per revolution" or per tooth, in milling. Let's keep "lead" for screw cutting.

•

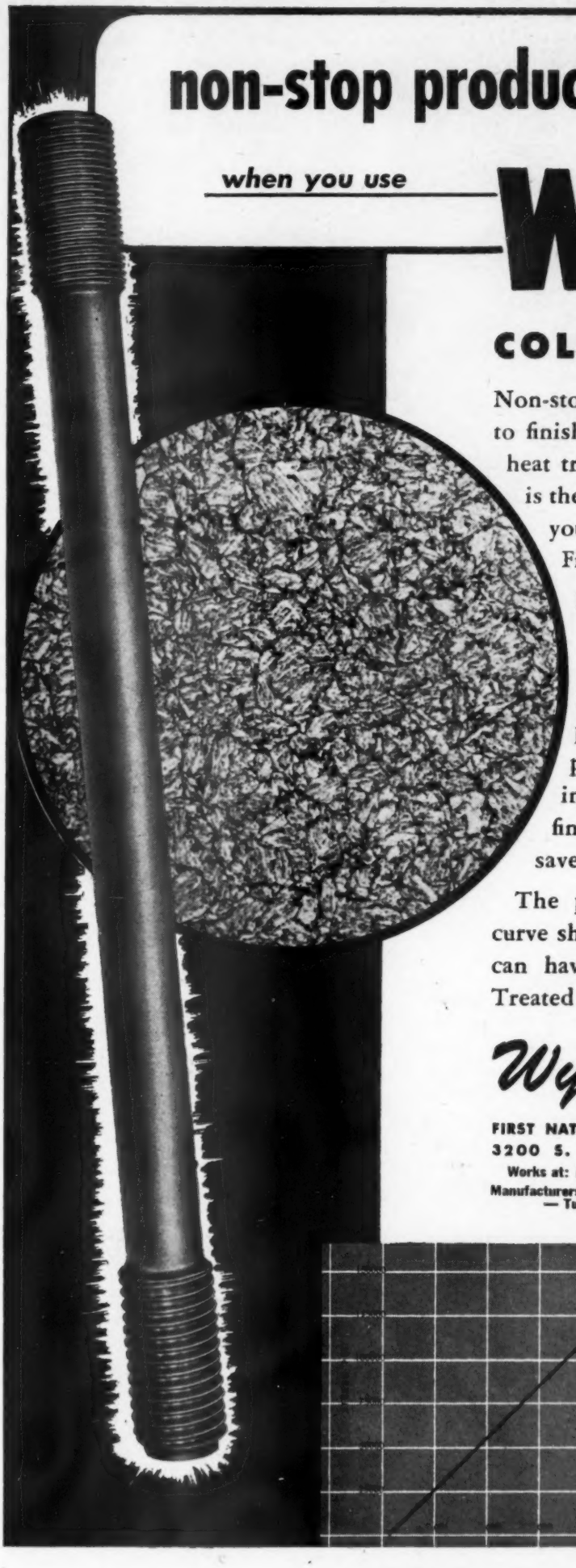
Screwy, But It Works!

FORMING THE FACES of abrasive wheels by forcing a hardened steel roll against them, as is now common practice in crushed wheel work, is one of the most striking examples

non-stop production cuts costs...

when you use

Wyckoff
HEAT TREATED
COLD FINISHED STEEL



Non-stop production . . . from bar stock direct to finished product without interruption for heat treating, cleaning or straightening . . . is the cost-cutting method you follow when you use Wyckoff Heat Treated Cold Finished Steel.

Heat Treated at the mill to your individual requirements, Wyckoff Steel provides you with *controlled* uniformity of physical properties in *your* production bar stock. Your parts production becomes a direct machining operation . . . individual testing of finished parts is eliminated . . . and you save several operations in the processing.

The photomicrograph and stress-strain curve shown are typical of the "picture" you can have *in advance* of the Wyckoff Heat Treated Cold Finished Steel you use.

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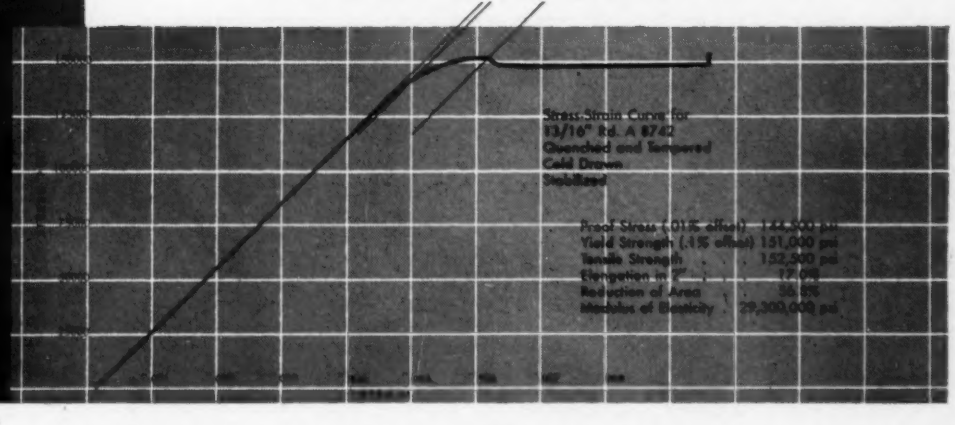

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Quick Shipment from Large Ryerson Stocks

It's just what you ordered because we continually check the size-accuracy, concentricity and straightness of our tubular stocks.

Its surface is smooth and scale-free because close control over every manufacturing step, from selection of the highest grade billets, through piercing and drawing, to the finished tube, assures a top quality product.

You'll find that constant experimentation to improve machining qualities has paid off in good machinability within the limits of the analysis specified. In short, nothing is overlooked that will help you put this tubing to work as a finished part, quicker and with less waste.

Convenience is another advantage of Ryerson service on tubular products. Large, diversified stocks are on hand for prompt shipment in twelve completely equipped plants . . . providing next-door service most everywhere.

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of changes in machine work. In the grindstone days, we sometimes forced a threaded roll against the face of the stone as it revolved to crush off the high spots. But more often we took the tang of a file or the end of a piece of pipe. And we found that soft metal was better than hard —or were we kidding ourselves?

But the chap who first dreamed of shaping an abrasive wheel for even a course thread by crushing its face, had his nerve with him. It isn't easy to see, even now, just why the grains of abrasive are accommodating enough to break away with sufficient accuracy to produce the ground threads we see everywhere. I take off my hat to the Englishman who had the nerve to try it first, for it evidently originated over there, probably from necessity in finding a way to finish round-top threads.

It is even worse to crush a wheel for our flat-top and bottom threads if we try to stick to the flat top and bottom with sharp corners. But as these sharp corners are a nuisance in more ways than one, we may as well forget them. We will probably come to use the round-bottom thread eventually and it isn't at all important just what shape the top or crest may be as it shouldn't bear anyhow. The whole idea of crushing grinding wheels seems sort of screwy —but it works!

"Quotes"

Steady Employment

HENRY FORD II had some down-to-earth things to say in discussing "The Goal of Steady Employment" before the Economic Club of Detroit recently. Said he, in part:

"The security which the American wage earner wants is not tied to any official scheme of government, the unions, management or anyone else. It is a broad and comprehensive desire. As a matter of fact, national surveys show that the average American worker would prefer to work out his own problem of security in his own way without help from employer, the state, or his union—provided only that he has steady work at good wages.

"The idea of steady employment is sometimes discussed these days under the title 'The Guaranteed Annual Wage.' In a great many ways this seems to me a poor choice of words. It is misleading. It comes a

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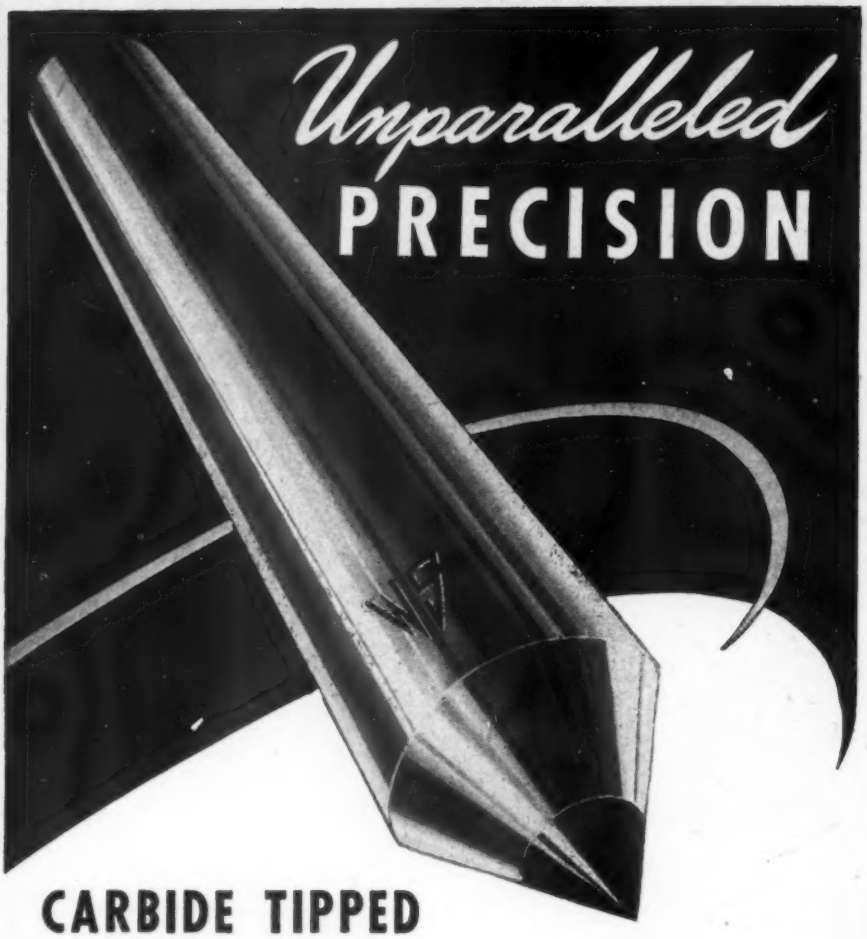

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little too close to being a political phony. It suggests that someone is in a position to guarantee an annual wage and is merely refusing to do so. I doubt very much whether the American wage earner really believes that anybody can guarantee security in this world. What he really wants is steady employment at a fair rate of pay.

This normal human desire on the part of our employees for greater stability in their jobs is a challenge to mass-production management. The production record during the first year of peace has turned the spotlight on some of the great difficulties to be overcome. We at Ford Motor Company are certainly not today in any position to guarantee an annual wage. But progress toward more stable employment is greatly to be desired. . . .

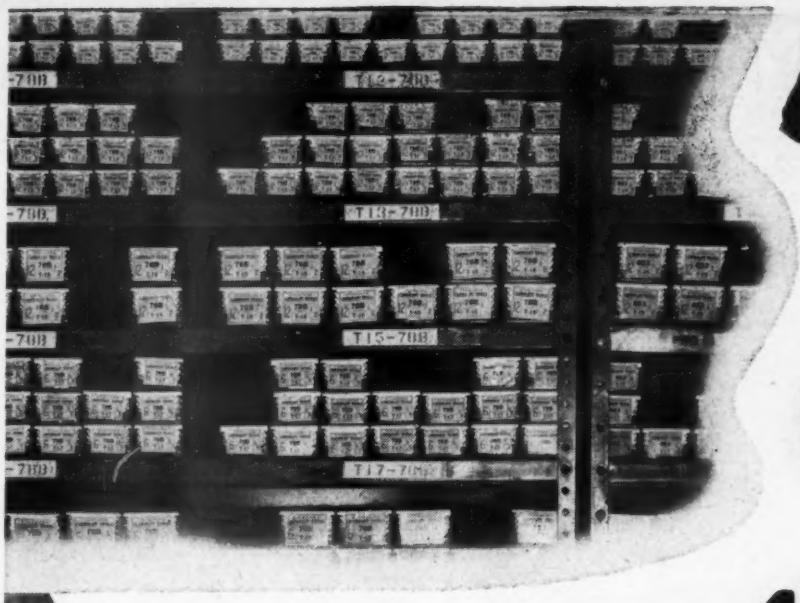
"Now this problem is too important to be treated in any way except with the utmost respect. No engineering problem in the history of the automobile industry was ever solved by catchwords or by ignoring the difficulties—and I am sure no human-relations problem will be solved that way either.

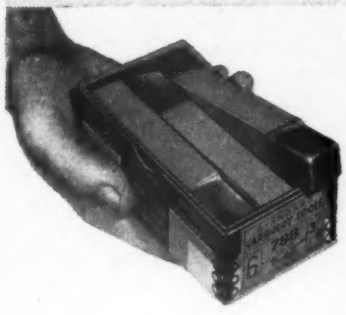
"It calls for hardheaded thinking. Any softheaded idea which promises that it cannot deliver and merely makes political capital of the deep human anxiety of all of us for greater personal security can only lead to delay and disappointment.

"First, any sound plan to provide more stable employment must increase production and reduce the cost of cars to the American people. The fault with most plans I have seen for a socalled 'Guaranteed Annual Wage' in the automobile business is simply that they guarantee an increase in manufacturing costs. Unless such a plan would clearly insure a substantial increase in *productivity* or in economies to offset the increase in costs, it is obvious that the result would be simply to increase the cost of automobiles. To that extent, the standard of living of all Americans would be reduced —including those who would seem to benefit from such a plan.

"Both management and labor will undoubtedly have to adopt new points of view if we are to approach even in one industry, new horizons in level employment. The solution to the problem seems to lie in two related goals: There must be great forward steps in the productivity of machines, and there must be an increase in the productivity of men. The first of these goals is obviously the responsibility of management. . . .

"Management can take the initiative in the field of human engineer-





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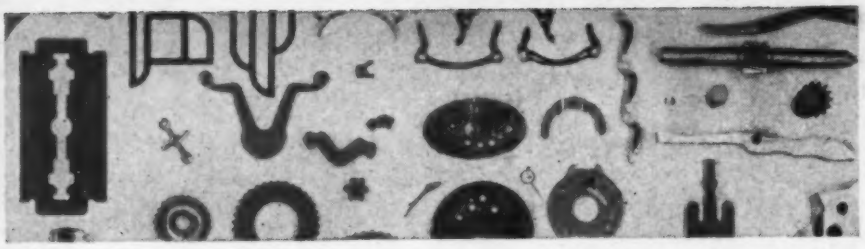

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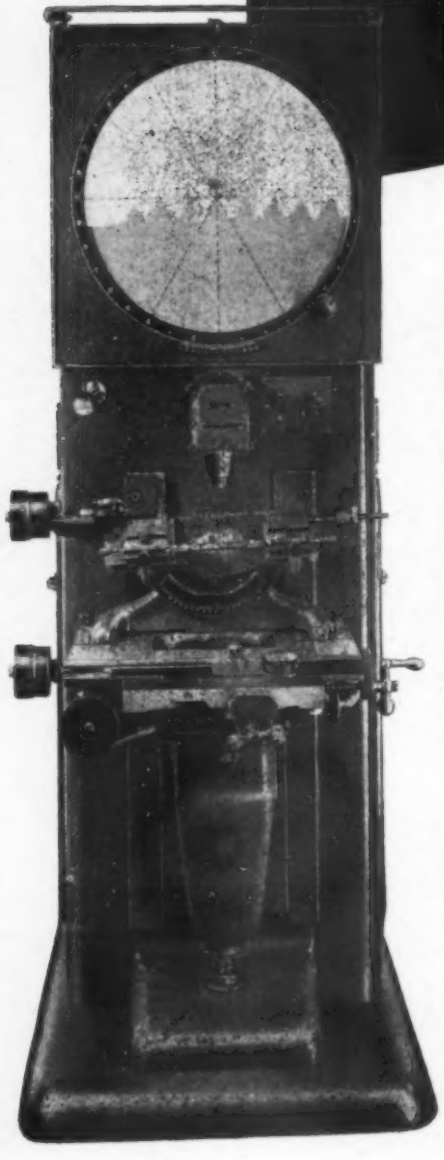

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ing, but labor must make a major contribution. Labor leaders, too, must apply fresh thinking to their policies and programs. Such familiar practices as feather-bedding; and the slow-down lead to decreased production—exactly the opposite direction from the one we must take if we are to achieve our goals. They spring from reactionary thinking. They are based on the assumption that we have gone as far as we can go and that security lies in 'made' work. Actually, it is increased output per man through the efficient use of machines which has always brought higher wages and shorter hours and has created more jobs by opening up new markets for what we make. . . .

"None of us—in management or labor or government—can afford to lose the democratic art of getting along with each other—of hopefully working toward common goals through compromise and agreement. We cannot afford to substitute, for a frank, honest approach to our problems, the political habit of painting situations either entirely black or entirely white, depending on who is doing the painting. Points of view can be honest disagreements of good Americans without becoming ballyhooed emotional differences of partisans. . . .

"Anyone who deals bluntly with the problem of steady employment will quickly face a sobering realization that the task is great and the difficulties many. I have expressed my feeling that three of the honest specifications for such a plan are that it must have the effect of increasing production, it must be approached with an open mind, and it must be entered into in the spirit of sincerity and cooperation."

NEW BOOKS

WAGES UNDER NATIONAL AND REGIONAL COLLECTIVE BARGAINING—*By Richard A. Lester and Edward A. Robie, Industrial Relations Section, Princeton University. Published by Princeton University, Industrial Relations Section. Princeton, N. J. 104 Pages. Price $1.50.*

Although only one of the seven industries (stove manufacturing) covered in this study of bargaining for wages is in the metalworking group, many of the findings are applicable and of interest to most industries faced with collective bargaining problems. One of the most interesting conclusions made by this

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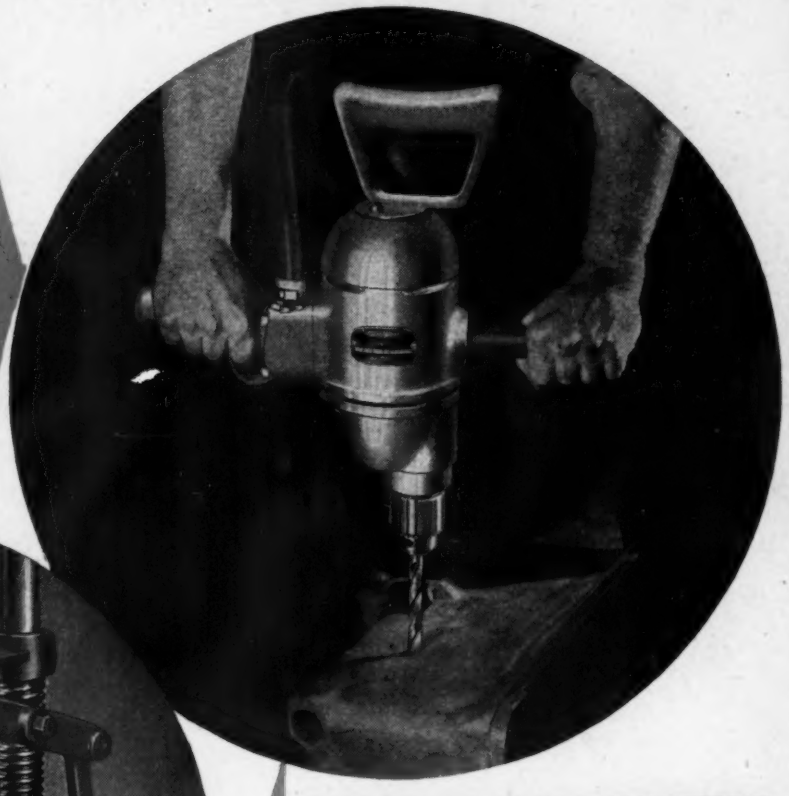

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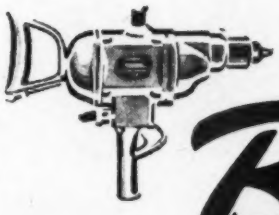

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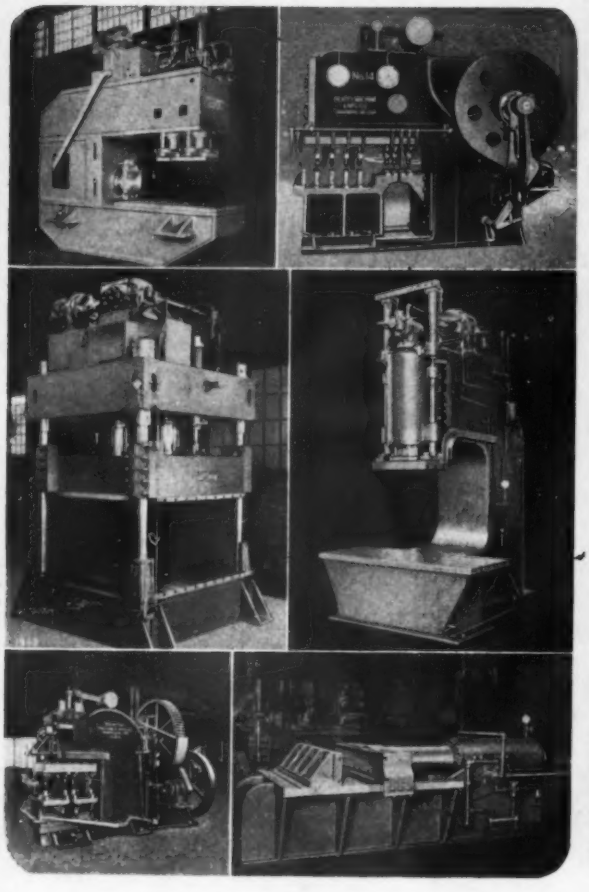

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study is that "wage uniformity is not essential" under collective bargaining agreements. The booklet also points out that in Sweden and England a specific pattern of geographic wage differentials has been established, and in the United States a fixed pattern of wage differentials based upon various criteria has been established for flint glass and silk and rayon dyeing and finishing plants. Other basic points in collective bargaining are made on the basis of analysis of the experiences and conditions of the industries analyzed, including glassware, pottery, stoves, hosiery, silk and rayon dyeing and finishing, flat glass, and west coast pulp and paper.

The brief discussions of wage agreements in Sweden and Great Britain should be of interest to both labor and management, especially in view of the older labor movements in those countries than here. For example, it is revealed that in Sweden there are wage differentials between the sexes, as well as other factors. Most readers will probably wish that this section of the study was more detailed.

■

How to Conduct Conferences—*By Alfred M. Cooper. Second Edition, published by the McGraw-Hill Book Company, 330 W. 42 St., New York 18, N. Y. 164 pages. Price $2.*

The original edition of this book was published just as this nation was entering World War II and the methods of conference leadership found wide application in discussion meetings of every type. Certain changes have been made in the revised edition to bring the material up to date. An example is a new chapter dealing with methods of conducting the labor relations conference, an application of conference procedure held important in the postwar industrial picture.

The book raises many questions which conference leaders might well stop and consider. It permits executives and others conducting conferences to analyze their techniques and determine what steps they can take to make conferences more productive.

The book outlines the development of a workable conference plan, the application of group motivation, and concrete methods by which the conference leader may conduct successful meetings. It enables the reader to make the conference an efficient tool for solving problems and getting things done, and to discover why past conferences have not achieved desired results. Methods for making conferences interesting and informative are suggested.

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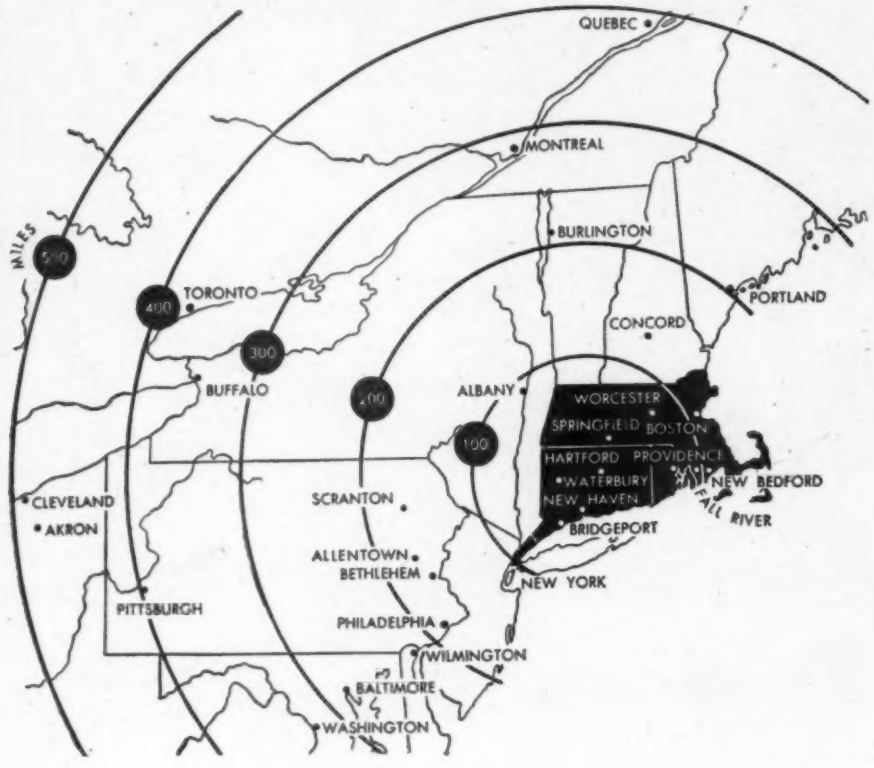

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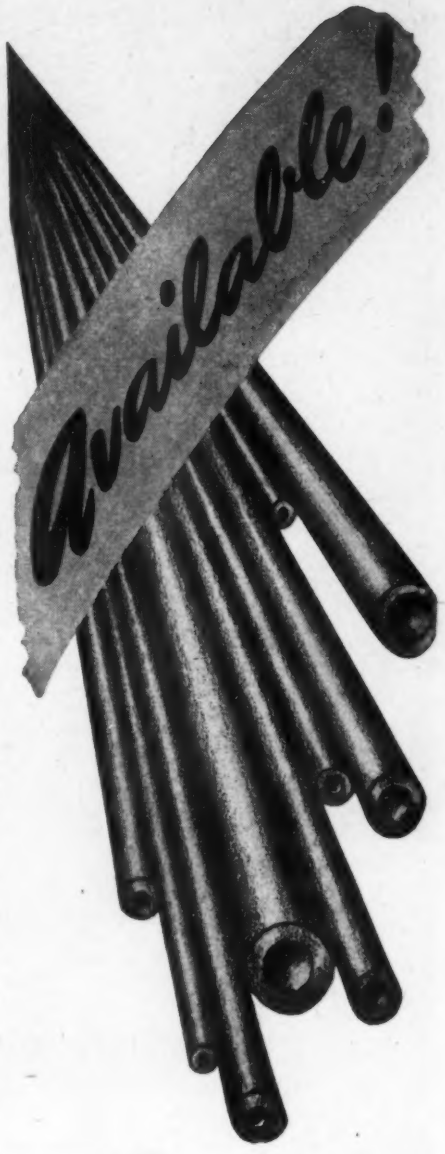

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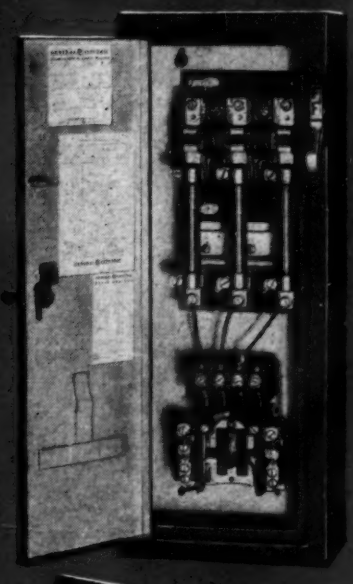
Sacking the seeds, one of the many processes controlled by G-E combination starters at the Rohnert plant



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AY DUN'T TANK DIS COMMITTEE EES DO SO MOOCH GOOD, FROM DE LOOKS!
OH, YES, THEY DID--TH' PRESIDENT'LL COME OUT TO SEE WHAT THEY MEANT-- HE'LL TAKE ONE STEP IN THAT GREASE AN' HE'LL FIND OUT! WHEN HE FALLS FLAT ON HIS FACE, HE'LL HOLLER TH' LOUDEST FOR SOL-SPEEDI-DRI.!
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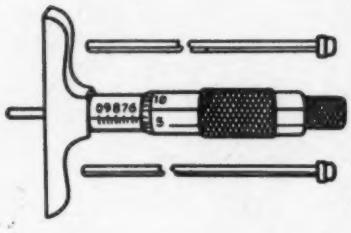


Designed for measuring holes, grooves, shoulders, etc., up to 3 inches in depth. Includes a set of interchangeable rods —1-inch, 2-inch and 3-inch, which are easily inserted and held to a positive seat by the knurled rod cap. There is an adjusting nut on each rod to compensate for wear.

The case hardened steel base is furnished in either 2½" or 4" lengths. Ends of measuring rods are hardened, precision ground and lapped. Furnished with or without case. Ask your jobber.

TU-MI-CO PRODUCTS

include a complete line of Micrometers, Pedestal Indicators and Micrometers, Standards, Steel Squares, and other practical measuring instruments. Ask your jobber.

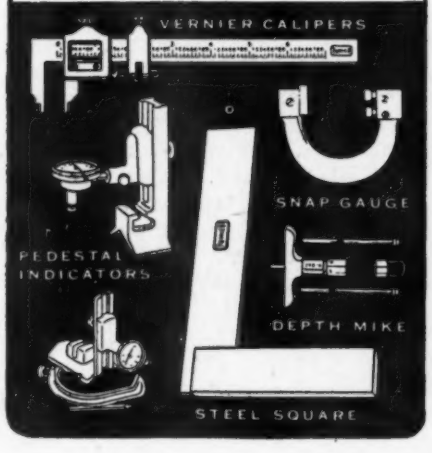
Precision is a TU-MI-CO tradition

WRITE FOR BULLETIN AM-D

TUBULAR MICROMETER CO.

ST. JAMES, MINNESOTA, U. S. A.

Milwaukee Branch • Plankinton Bldg.



EMBLEM OF SERVICE
INCO
THE INTERNATIONAL NICKEL COMPANY INC. NEW YORK 5 N.Y.
FOR DEPENDABLE PERFORMANCE
STAINLESS
ALLOY STEELS
ALLOY CAST IRON
An Invitation
Visit our Exhibit on the Stage at the
NATIONAL METAL EXPOSITION
Atlantic City, N. J., November 18-22, 1946
This exhibit, covering the entire stage of the municipal Auditorium, will show many examples of the advantages that Nickel offers your industry. Convenient facilities for discussing your problems with our metallurgists and foundry specialists, will be available.
THE INTERNATIONAL NICKEL COMPANY, INCORPORATED • 67 Wall Street, New York 5, N. Y.

Recent view of part of the McCaskey Production Control System now used by Mathias Klein and Sons, Chicago, Illinois.

McCASKEY provides Complete Production Control for Twenty-Three Years . . . with 30% Saving in Time and Routine

●

THE effectiveness of the McCaskey *One-Writing and Visible-Filing System* of control is again demonstrated—this time by a twenty-three years service record in the plant of Mathias Klein and Sons, Chicago, Illinois.

Their system provides Mathias Klein and Sons with control of work-in-process by operations, perpetual inventory of raw materials and subassemblies, payroll records and distributions and operation costs. The status and progress of hundreds of jobs involving from three to fifty operations each are constantly available at a glance.

About eight months after the system was originally installed, Mr. J. A. Klein, Jr., then Superintendent and now President, commented that their McCaskey System had reduced time and clerical work 30%, provided control that was more accurate than the posted records replaced and made available complete monthly analyses approximately two weeks earlier than before.

What was true then is true today, and their requirements have increased both in size and the complexity that results from present operating conditions. Changes in detail have been made to meet the expanded needs of the organization, but the basic principles, proved right 23 years ago, have not been altered.

Hundreds of manufacturers are using McCaskey Systems, equipment and factory forms to tighten up various controls of production. McCaskey Controls may be the answer to some of the excessive costs or delays that are bothering you now. And they do not require a big investment. Let us give you more facts about their application to your requirements. Write for "The ABC's of Production Control."

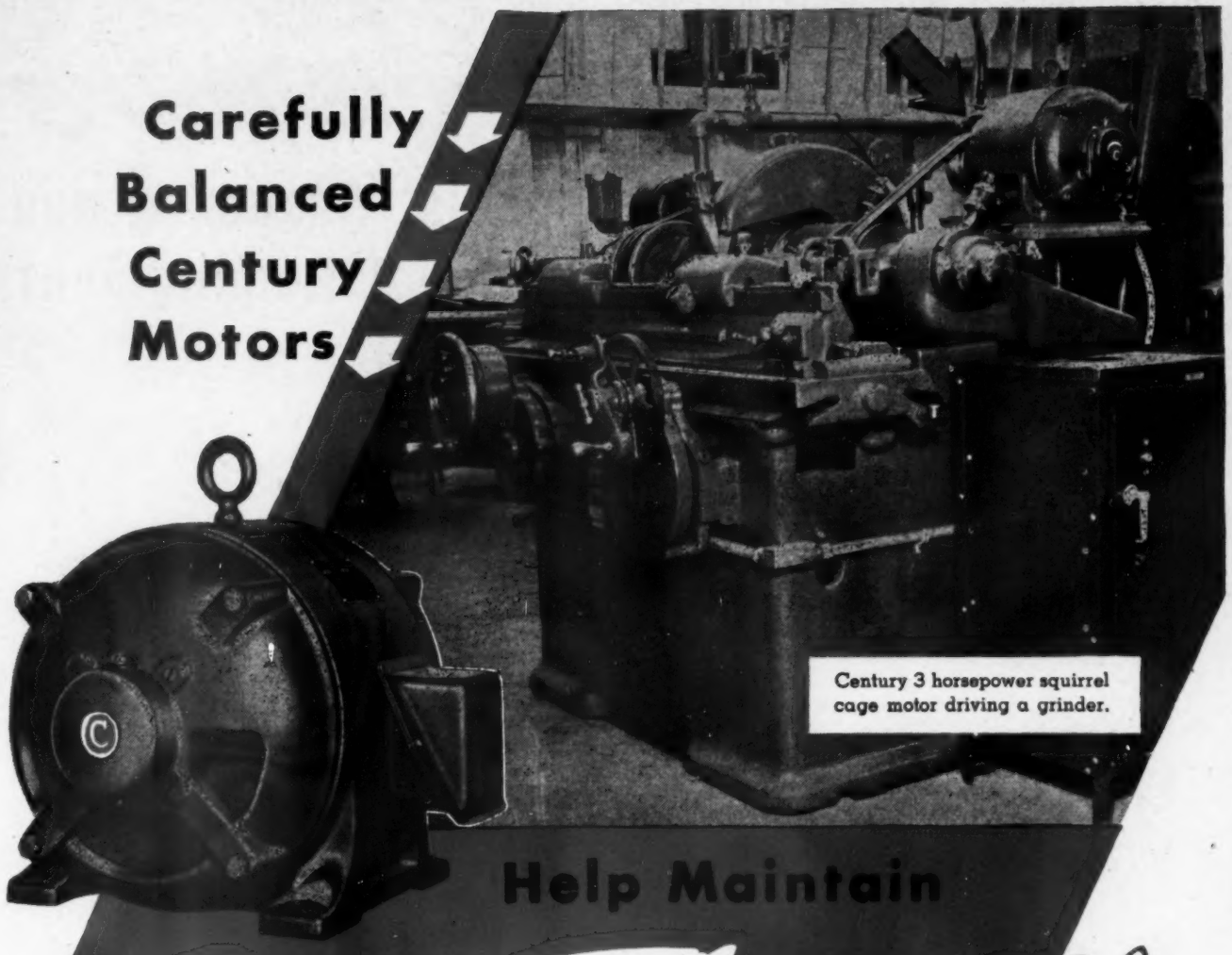
THE McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCaskey Systems Ltd., Galt, Ontario, Canada — *The McCaskey Register Co., Watford, England*

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

Carefully Balanced Century Motors



Century 3 horsepower squirrel cage motor driving a grinder.

Help Maintain Closer Tolerances

The unusual freedom from vibration of Century Motors means that the accuracy of your Century powered machines is protected. You get all the precision your equipment is designed to give. Production rejects are fewer.

Century motors maintain their smooth starting and running qualities throughout a long life of satisfactory service, because they are ruggedly built to withstand the toughest kind of service.

Century's wide range of types and sizes from 1/6 to 400 horsepower enables you to select the correct standard Century motor for your application — without sacrificing the qualities necessary to the operation of your equipment. Specify Century on all your electrically powered equipment.

Century C MOTORS

CENTURY ELECTRIC COMPANY

1806 Pine St. • St. Louis 3, Mo.

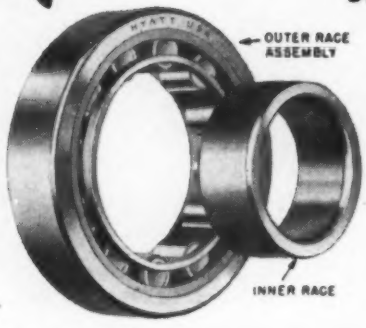
Offices and Stock Points in Principal Cities

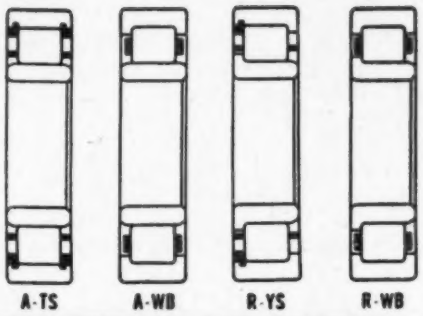
492

Hyatt has the Answers

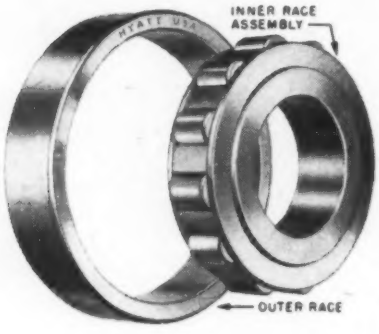
To Special Assembly and Operational Requirements

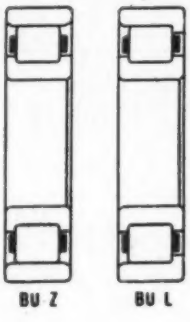
BEARINGS WITH SEPARABLE INNER RACE





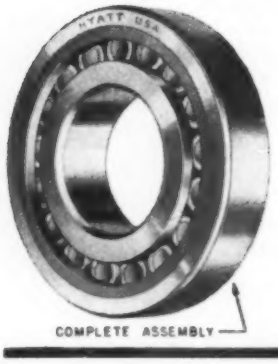
... WITH SEPARABLE OUTER RACE

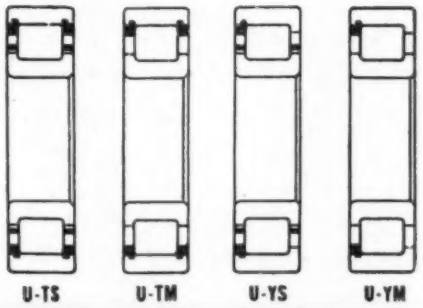




Component parts of all Hyatt Hy-Load Bearings with separable races are fully interchangeable; thus selective fitting of sub-assemblies is not required. The separable race can be omitted when shaft or housing is of sufficient hardness — providing further advantages in machine design.

NONSEPARABLE BEARINGS





For applications where the bearing must be assembled as a complete unit, Hyatt has these nonseparable types. May also be used in applications where no shoulder stop is provided to retain the outer race endwise.

EACH TYPE IS AVAILABLE in a wide range of sizes, offering maximum capacity for standard A F B M A dimensions. New 88-page Hy-Load Catalog, just off the press, gives complete information. Write now for your copy. Hyatt Bearings Division, General Motors Corp., Harrison, N. J.

HYATT ROLLER BEARINGS

Put your mind on a BLANK!

A plastics blank, of course . . . a blank punched from BAKELITE plastic molding board that *could* be the answer to one of your supply problems.

For many manufacturers, here is an idea that might go far toward easing the present stringency in supply of molded plastic parts. For certain uses . . . particularly for flat shapes . . . BAKELITE molding board provides a shock-resistant plastic in a more workable, convenient form. It is more readily available, and it may often be substituted in whole or in part, for other types of molding plastics. For general molding requirements the material is supplied in a special "diced" or cubed form that can be pre-formed on automatic tabletting machines. Regardless of form in which supplied, these molding board plastics anchor metal inserts securely, give great impact strength to heavy duty parts and staunch reinforcement at vital points—and yet *they can be molded in general-purpose molds.* Isn't this worth discussing with your supplier?

BAKELITE phenolic resin molding boards, blanks, and diced material give high moisture resistance and excellent dimensional stability in addition to impact strength. The blanks are furnished in disk, rings, rectangles or squares in various thicknesses. A rich, glossy black is the final color.

BAKELITE'S engineers will be more than glad to consult with you and your suppliers and help you determine new ways to improve your production and extend your supplies of plastics. Write Department 35 for full information.

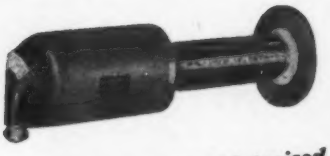
TRADE-MARK®

BAKELITE

MOLDING BOARDS and BLANKS

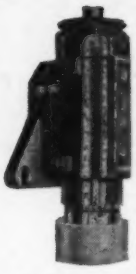
BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 East 42nd St., New York 17, N. Y.

These POPE PRECISION SPINDLES are ready to go to work in your grinders

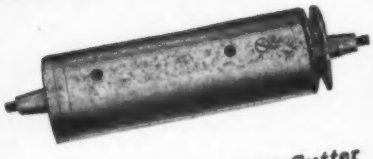


This POPE *Sealed Motorized Spindle* is recommended for all makes of 6" x 18" surface grinders. It has sealed-in 1 H.P. G-E motor and sealed lubrication, SKF super-precision, double row roller bearings. It assures finer finishes and more production per day and per Spindle.

This POPE *Internal Grinding Spindle* with sealed lubrication and speeds up to 35,000 RPM is recommended for the production of more accurate hole sizes and better finishes. It comes in a wide range of sizes and speeds.



This POPE *Motorized Spindle*, with Sealed Lubrication and with 3, 5 or 10 H.P. motor running at 1200, 1800 or 3600 RPM is recommended for a broad range of surface grinder and boring applications. It has the bearing capacity and the rigidity to rough off surplus metal fast and produce a better final finish. It will run in any position.



This POPE *Tool and Cutter Grinder Spindle* with Sealed Lubrication is operated by single Vee belt drive at speeds up to 6000 RPM. It meets POPE standards of precision, efficiency and lasting performance. Fits standard grinders.

This POPE *Double-Ended Tool and Cutter Grinder Spindle* with Sealed Lubrication is designed for twin belt pulley center drive at speeds up to 6000 RPM. Fits standard grinders.

These modern "Package Units" have a sealed-in supply of lubricant good for the life of the bearings. Each is a product of extensive research and long experience in the design and manufacture of Precision Spindles. For prompt action get in touch with Spindle headquarters . . .

No. 38

POPE

POPE MACHINERY CORPORATION

ESTABLISHED 1920

261 RIVER STREET • HAVERHILL, MASSACHUSETTS

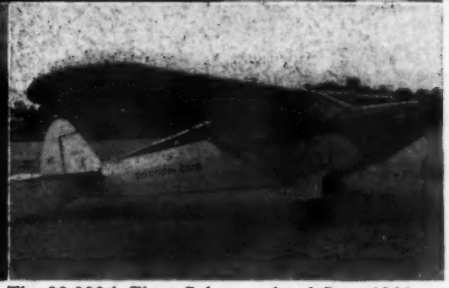
BUILDERS OF PRECISION SPINDLES

"DRIVE TWICE AS FAST"

—Phillips Screws help Piper build 1100 Cubs a month!

20 Phillips Screws hold instruments in panel, and six more fasten panel to cowling of the Cub Super Cruiser. Before using Phillips Screws, one driver slip often required removal of all screws and scrapping or repairing damaged panel.

Fastenings near fabric covering—no place for driver slips—no slips with Phillips Screws.



The 20,000th Piper Cub, completed June 1946. Phillips Screws speeded this big production!

"We started using Phillips Screws back in 1938, when . . . and because . . . we were getting set for large scale production," declared Piper's Assistant Chief Inspector to the James O. Peck Co. investigator, studying assembly savings with Phillips Screws in well-known plants. "Today we're shipping our 20,000th Piper Cub. That proves how much faster Phillips Screws are to drive.

"IDEALLY SUITED TO POWER DRIVING, which we needed for high production. Unlike slotted screws, Phillips Screws hold the driver bit in place without a guide or other support, automatically center themselves in the screw holes and catch the thread quicker. Phillips Screws are easily twice as fast to drive.

"TAKES LESS TIME TO MAKE SKILLED ASSEMBLERS. It takes a man much less time to become familiar with and do a good job of driving Phillips Screws. Since the Cub is fabric covered, any driver slips would cost us expensive, undesirable patching, doping and repainting . . . up to $1.00 a slip. Same thing on the instrument panel where a single driver slip would cost up to $3.50. If we were using slotted screws, assemblers would have to go much slower, especially at the learning stage, to avoid such damage.

"WE GET A BETTER INSPECTION. Don't have to watch out for burred heads as we used to do with slotted screws. Fabric tears and instrument panel scratches are out. And the Phillips Recessed Head certainly makes a more attractive, workmanlike job wherever screw heads are exposed."

GOOD IDEAS FOR YOUR ASSEMBLY LINE in this independently made report of Piper's assembly savings with Phillips Screws. Similar studies . . . covering metal, wood and plastic products . . . available to you without cost or obligation. Use the coupon TODAY!

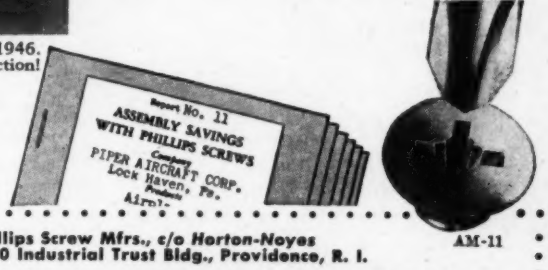
PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

American Screw Co.
Atlantic Screw Works
Atlas Bolt & Screw Co.
Central Screw Co.
Chandler Products Corp.
Continental Screw Co.
Corbin Screw Div. of American Hdwe. Corp.
The H. M. Harper Co.
International Screw Co.
Lamson & Sessions Co.

26 SOURCES

Milford Rivet and Machine Co.
National Lock Co.
National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
Stronghold Screw Products, Inc.
Wolverine Bolt Company



Phillips Screw Mfrs., c/o Horton-Noyes AM-11
2300 Industrial Trust Bldg., Providence, R. I.

Send me reports on Assembly Savings with Phillips Screws.

Name.....

Company.....

Address.....

$300 WORTH OF TECTYL SAVES $15,000

Pittsburgh Post-Gazette

CARNEGIE HAS $500,000 FIRE

Industrial Plant Swept by Flames After Explosion

Molds left in ruins of fire for 3 months completely salvaged with Tectyl 600

Typical mold being dipped in tank of Tectyl 600.

Following a fire which completely destroyed the Keystone Abrasive Corp. plant at Carnegie, Pa. last spring, $15,000 worth of precision molds and delicate tools became badly rusted.

Pending the insurance adjustment, it was necessary to leave them in the ruins, untouched, for three months. Though apparently beyond salvage, this equipment was completely reclaimed by treatment with Tectyl 600.

The molds treated had tolerances of from .0005 to .005 of an inch; any attempt to machine off the rust would have destroyed their usefulness. The whole job was done in less than 3 days — without rubbing — with Tectyl 600. $300 worth of Tectyl saved this company $15,000!

Tectyl is also made in many specialized types for the protective coating of metals exposed to rust

- One application of Tectyl protects against rust and corrosion up to 2 years.
- Tectyl is not a paint; it leaves a thin, transparent film that keeps the metal in plain sight. Tectyl need not be removed for inspection.
- Tectyl is easy to apply — brush on, flush on, dip, or spray.
- Tectyl is easy to remove with kerosene or any ordinary hydrocarbon or naphtha compound. Tectyl saves time and labor.
- Tectyl is economical — a little Tectyl protects a lot of metal — Tectyl provides low-cost-per-square-foot protection!
- There's a Tectyl solution for every rust problem.

Phone, write or wire for Tectyl bulletin and specific recommendations for your needs. Please describe metals and types of exposure encountered.

VALVOLINE **TECTYL** *ENDS RUST*

FREEDOM-VALVOLINE OIL COMPANY

DEPT. 38K, FREEDOM, PENNSYLVANIA

New York - Toronto - Pittsburgh - Detroit - Atlanta - Cincinnati
Chicago - St. Louis - Los Angeles - San Francisco
Portland - Seattle - Vancouver

SPEED CUTTING OPERATIONS

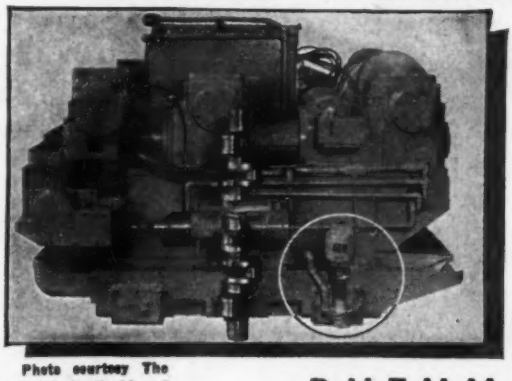


Photo courtesy The Crankshaft Machine Co.

WITH

RUTHMAN GUSHER COOLANT PUMPS

To speed production on metal cutting operations turn to Gusher Coolant Pumps.

Illustrated is a "MELLING" TYPE CRANKSHAFT CONTOUR TURNING LATHE, made by the Crankshaft Machine Company and equipped with a ¼ H.P. MODEL SLO-7230 RUTHMAN GUSHER COOLANT PUMP.

Satisfied customers are your guarantee of the service a "GUSHER" will give you. Always specify them on your machines.

Write for Catalog 10A

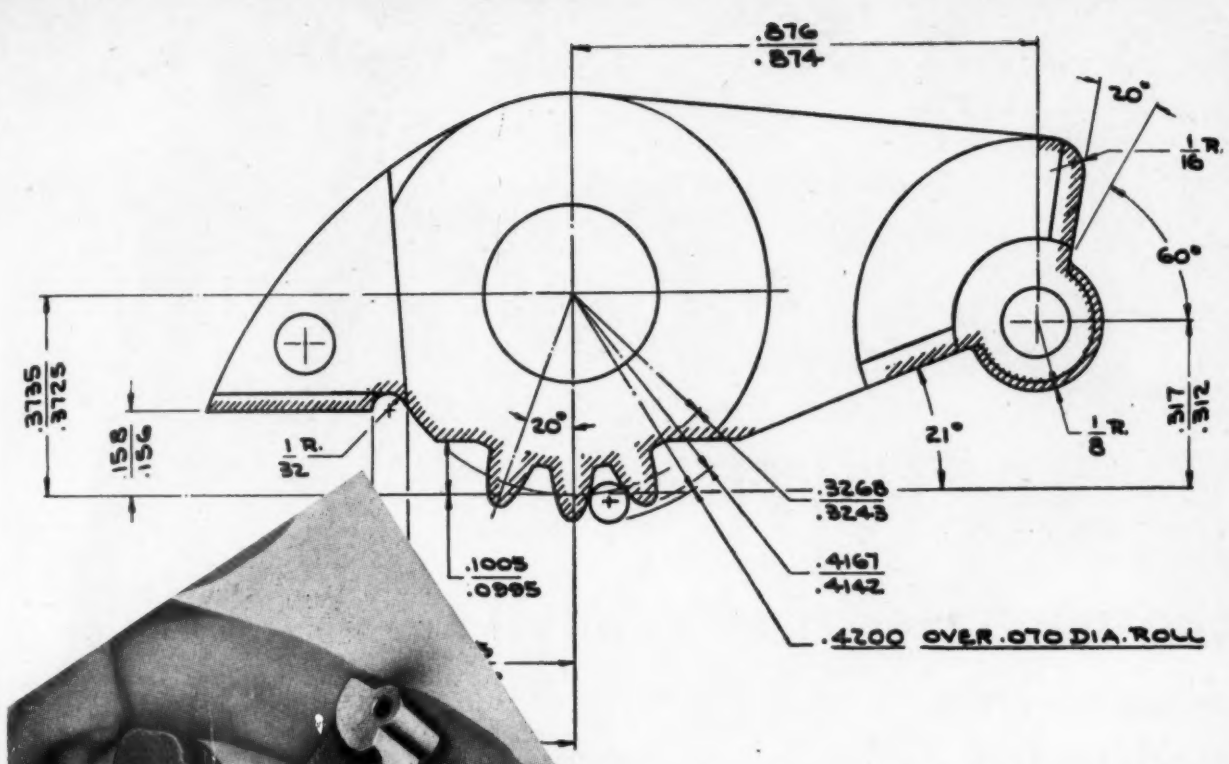
Model TL 7320

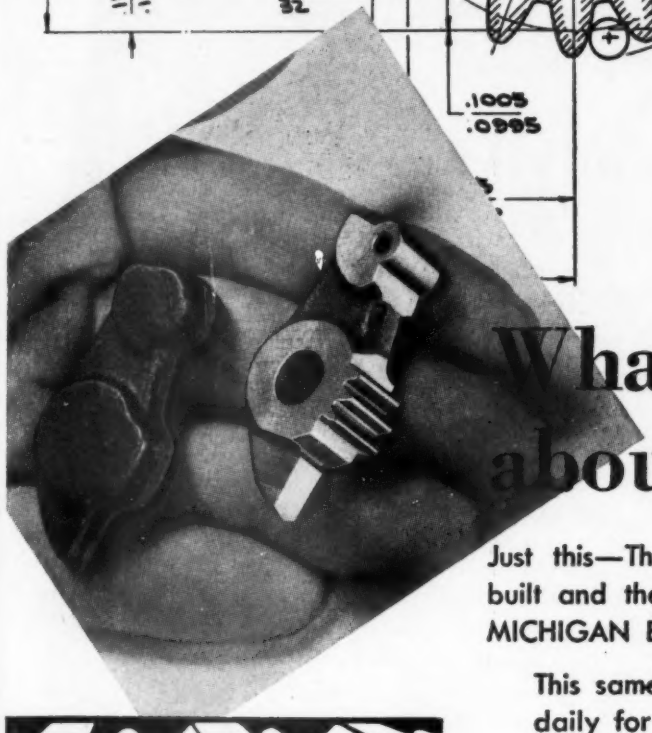
THE RUTHMAN MACHINERY CO.

1889 READING ROAD, CINCINNATI, OHIO

BACKGROUND for QUALITY in BEARING BALLS

THE ABBOTT BALL COMPANY, HARTFORD 10, CONN.



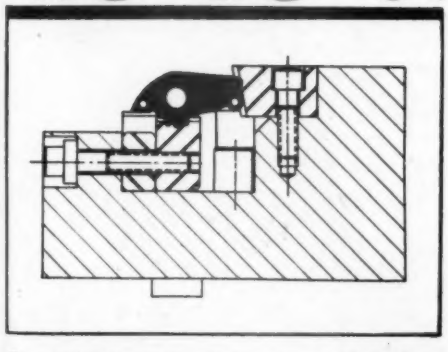


What's so different about *this* part?

Just this—The job was engineered—the tools were built and the part was machined by ONE SOURCE, MICHIGAN BROACH.

This same *"complete service"* is being performed daily for many customers and being performed at reduced costs. MICHIGAN'S "know how" in *designing, building* and *using* broaches makes this possible.

MICHIGAN, long recognized as one of the industry's most reliable sources for broaches, fixtures and gages, also operates the largest commercial machine shop of its kind in the country for *furnishing complete parts.*



Four milling operations were required to machine this contour. It was broached in one operation. Broaching is faster, reduces scrap, requires less skilled labor.

Send your next part to MICHIGAN for machining or have MICHIGAN quote on furnishing it complete.

The new NUMBER 8 folder is off the press. Write for your copy. It deals with an interesting phase of broaching.

MICHIGAN BROACH CO.

Announcing

SEALTITE*

...the new electrical conduit

"made-to-order" for the National Machine Tool Builders Association

"SEALTITE" CONDUIT, a brand new product, engineered from the ground up to meet Association requirements, consists of a core of galvanized steel flexible tubing covered with a thick, water and oil proof extruded-on coating of synthetic insulating material. Conduit fittings are made with standard pipe thread and are permanently attached at the factory if desired, or may be furnished for attachment on the job when preferred. "Sealtite" Conduit is made in all normally used sizes up to 2" I.D. and, together with fittings, is carried in stock in mill lengths to meet your immediate requirements *promptly*.

To meet the shortcomings of ordinary wire insulation or simple conduit where oil drip or moisture seep through too readily, causing shorts, rotted insulation, high maintenance and down time on machines, "Sealtite" Conduit is liquid-tight, resistant to abrasion and compression and readily bendable to small radii.

"Sealtite" is designed and built by American Metal Hose especially to meet the Electrical Standards specifications of the Association under "Automotive Standards," paragraph 4.6.3. Write for prices and detailed information. *Trade-mark 46357

ANACONDA

American Metal Hose

THE AMERICAN BRASS COMPANY

American Metal Hose Branch

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

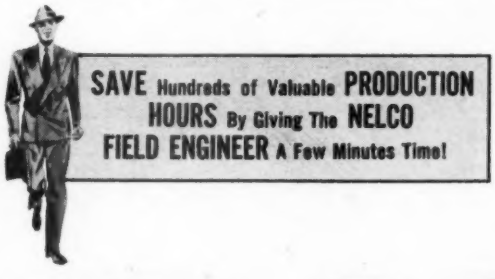
For That Extra Edge In Production

Nelco Carboloy-Tipped Side Milling Cutters *(for Straddle Milling, Half-Side Milling and Slotting)* mill up to 20 times faster than old-style tools. In addition, these cutters produce many more pieces between grinds with a much finer finish.

Designed by craftsmen with custom-built precision that insures better production and workmanship, Nelco Side Mills have all-alloy steel bodies . . . thicker, sandwiched-brazed, diamond-ground tips that assure longer tool life and more regrinds.

These Nelco tools are copper or cadmium plated for quick job identification and to prevent rust: copper plated for steel and steel alloy jobs; cadmium plated for non-ferrous, cast iron and plastic material jobs.

All these extra features at no extra cost are found only in Nelco Carboloy-Tipped Side Milling Cutters . . . manufactured in sizes from 3″ to 8″ dia. and 1/8″ to 1″ width, and are available from stock. All Nelco tools are shipped individually protected by a plastic coating.



On Request!

Your copy of this new 28-page catalog illustrating and describing the complete line of Nelco Carboloy-Tipped Cutting Tools. Includes valuable engineering data and price lists. Send for it today.

NELCO TOOL CO., INC.

For That *EXTRA EDGE* In Production

Executive Offices and Plant

370 Hamilton Avenue, Dept. 4, Brooklyn 31, N. Y.

Any One of These Well Known Distributors Will Be Glad To Serve You

Albany—Sager-Spuck Supply Co., Inc.
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York, Pa.—L. A. Benson Co., Inc.

FORGING H-P-M presses for flat and closed die forging are revolutionizing the forging industry.

FORMING H-P-M presses are ideally suited for forming heavy metal parts.

DRAWING H-P-M presses are the production standard for deep sheet metal drawing.

THE H-P-M *All-Hydraulic* PRESS ...Industry's Most Versatile Production Machine For PRESSURE PROCESSING

Most products, regardless of their nature, require the application of pressure in their manufacture. In these industries, H-P-M self-contained hydraulic presses are revolutionizing production technique. Deeper draws, less rejects, fewer operations, better grain structure, more even density, faster production and less maintenance are natural results of applying modern H-P-M hydraulics to pressure processing problems. All of these worthwhile features result in *lowering manufacturing* costs.

For 69 years, The Hydraulic Press Mfg. Company's activities have been devoted exclusively to the production of hydraulic presses. This specialized effort has resulted in the most versatile line of all-hydraulic press equipment ever offered for pressure processing. H-P-M is the only builder of completely integrated presses, with press frame, pumps, valves and controls all built by a single organization. Investigate H-P-M presses for your pressure processing work. H-P-M engineers will be glad to discuss your production problems. Write today, stating your requirements.

THE HYDRAULIC PRESS MFG. COMPANY
Mount Gilead, Ohio, U.S.A.

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DIE CASTING H-P-M high pressure metal die casting machines are of revolutionary all-hydraulic design.

BENDING H-P-M presses are built for diversified bending of large diameter tubing, structural steel, etc.

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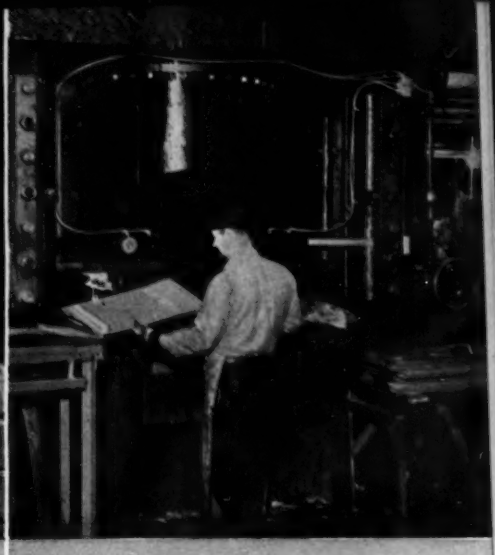
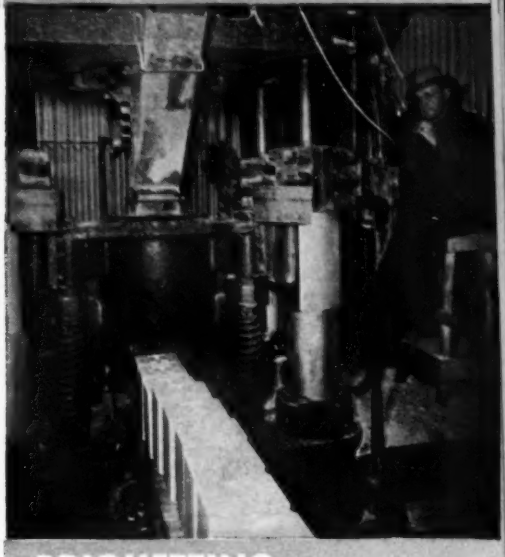
STRAIGHTENING H-P-M presses are universally accepted for die straightening malleable castings.



EMBOSSING H-P-M presses provide the answer to mass production metal embossing problems.



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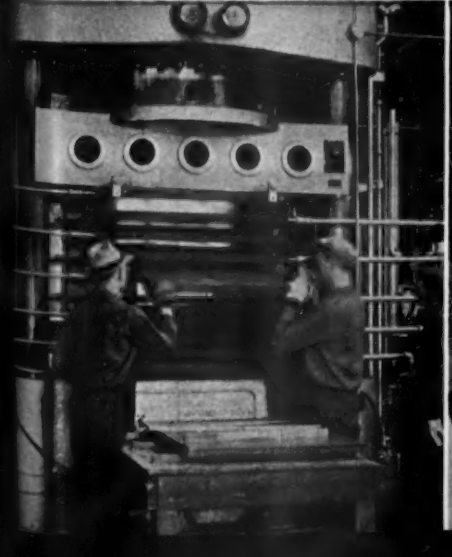
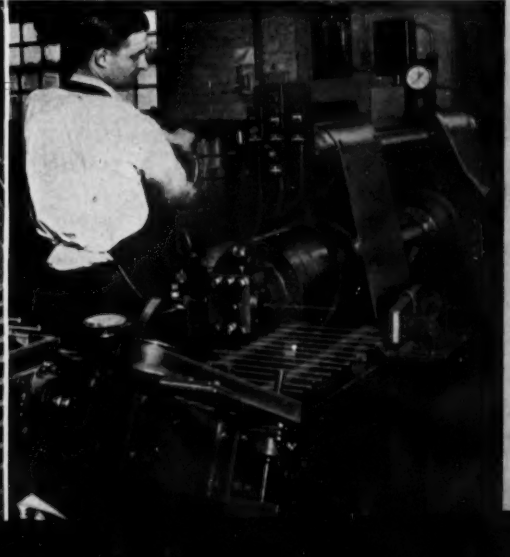
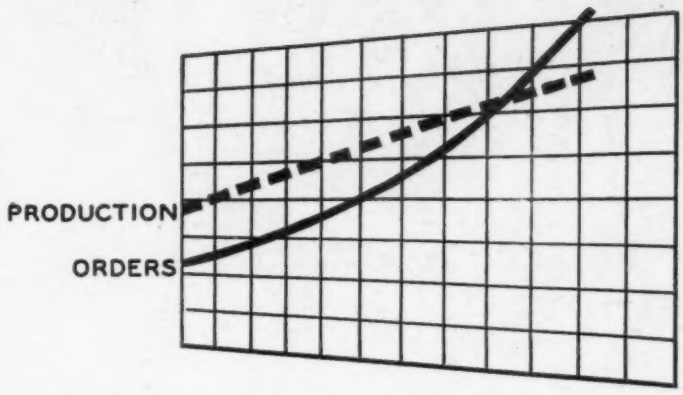


STEEPING H-P-M presses are employed by leading producers of viscose rayon and cellophane.

EXTRUDING H-P-M extruding presses are used principally to coat welding electrodes.





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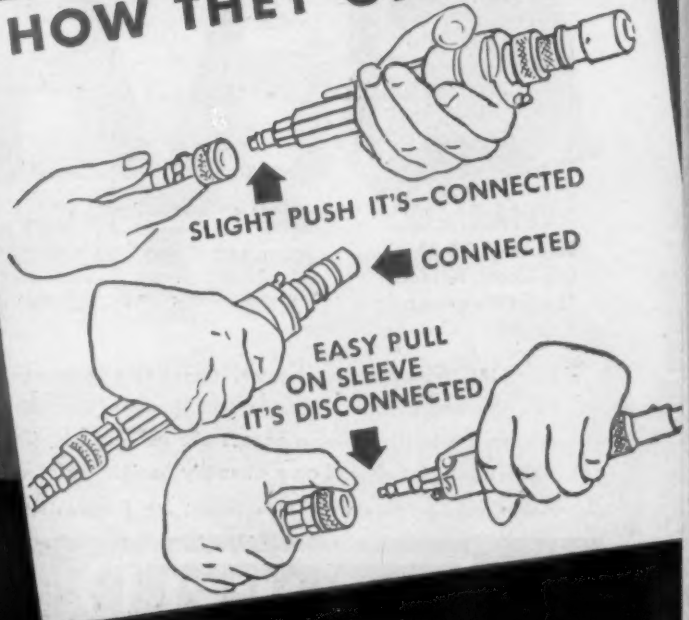

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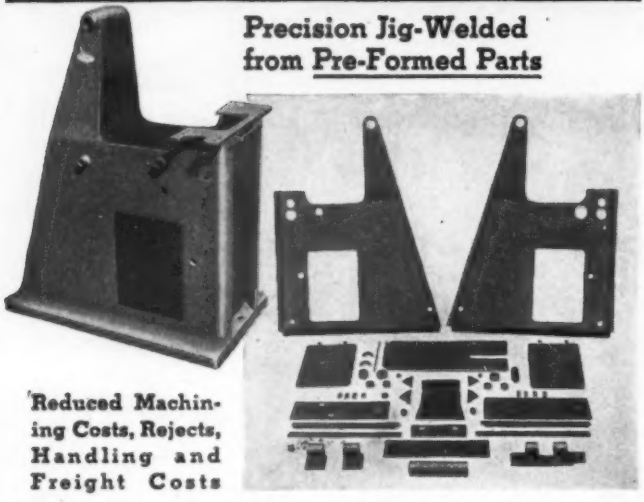

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BY EUGENE L. GRANT

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—fundamental statistical concepts
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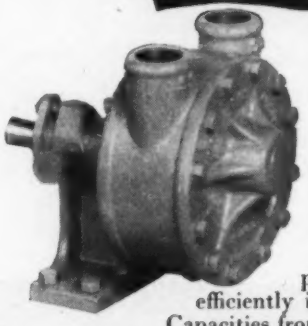

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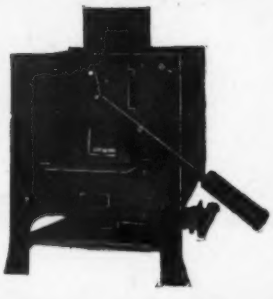

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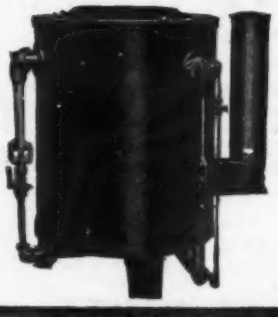

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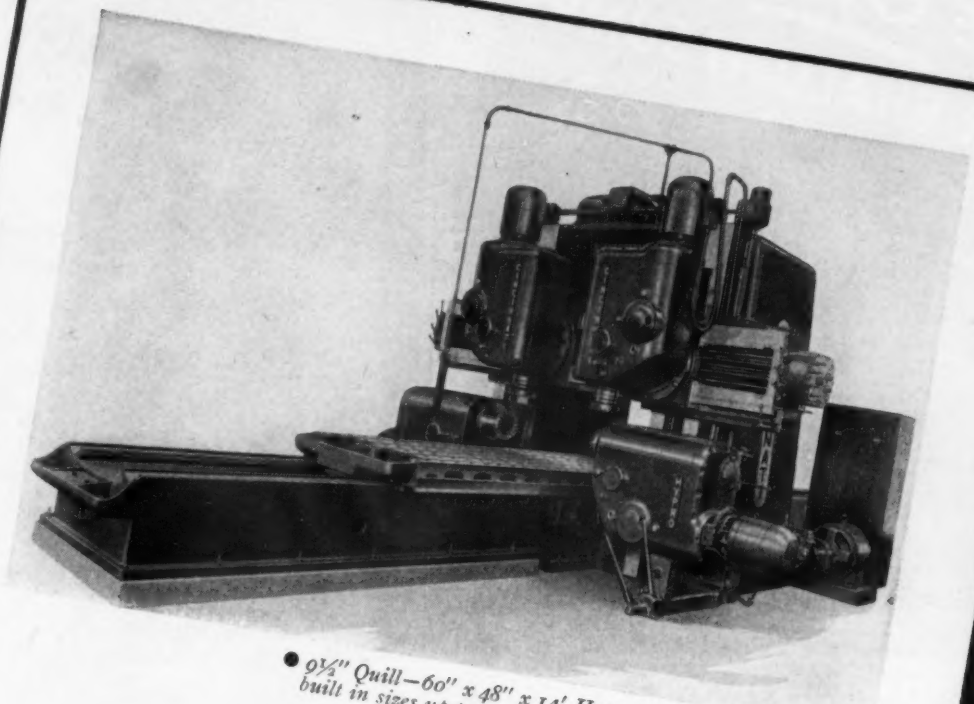

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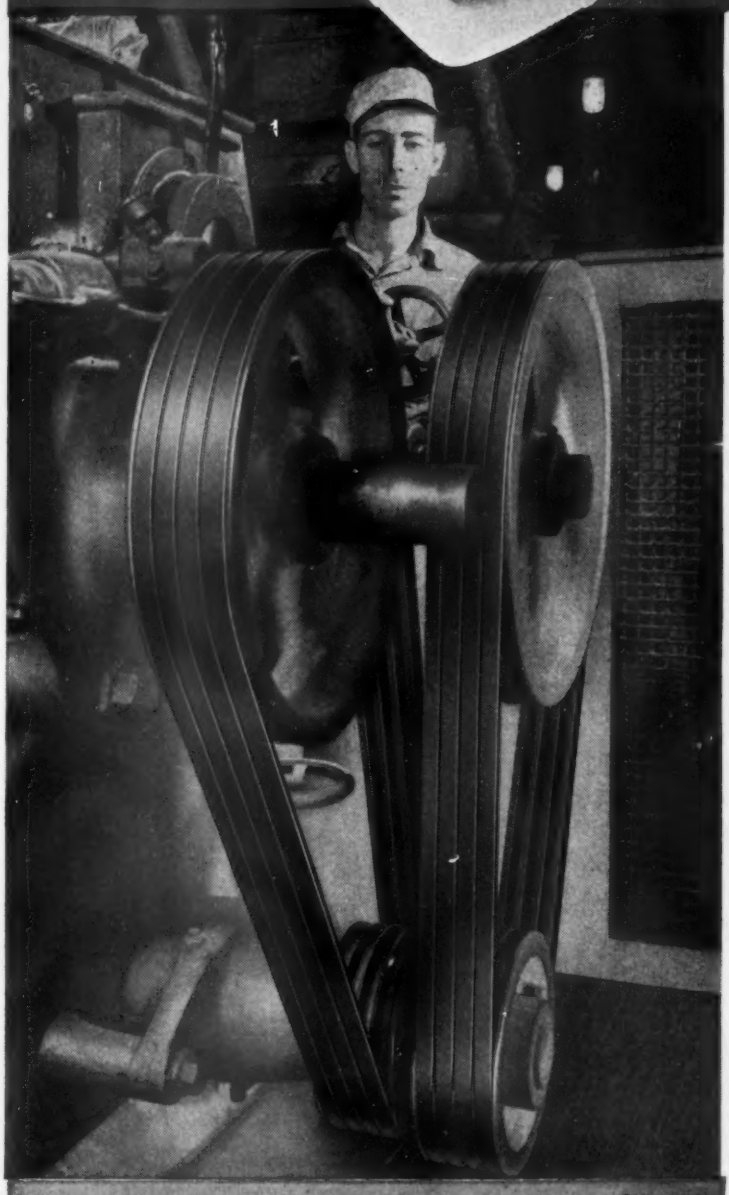

In one of the country's large flour mills a huge machine grinds 8000 bushels of wheat per hour. The original belts on the power drive of this grinder gave considerable trouble because they slipped, reducing the speed of the grinder. All too frequently the belts slipped completely off the pulleys, stopping the grinder. Then Dayton V-Belts were installed. Since then the grinder has not stopped once due to belt failure, and slippage has been completely eliminated. More flour per hour is the result. Dayton V-Belts transmit power positively because they are engineered for their job. Their scientific design makes them seat themselves firmly in the pulley grooves and the harder the pull, the more firmly they seat. There is no chance for slipping! Dayton V-Belts are the result of more than 40 years of research and manufacturing experience building products of *specialized* rubber for specific industrial jobs. It is experience that can help you solve your power transmission problems. Write today to The Dayton Rubber Manufacturing Company, Dayton 1, Ohio.

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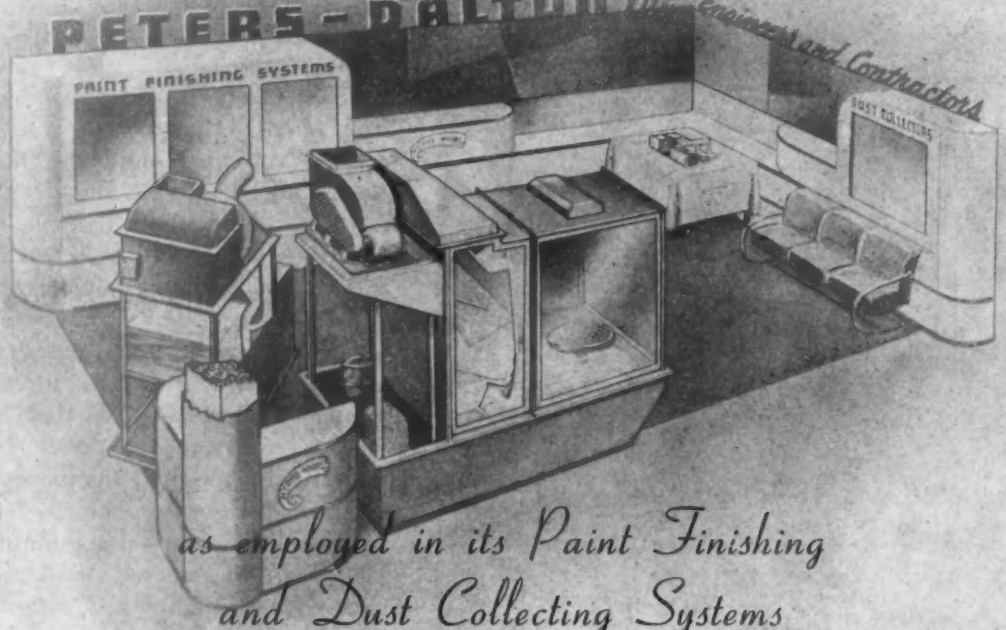

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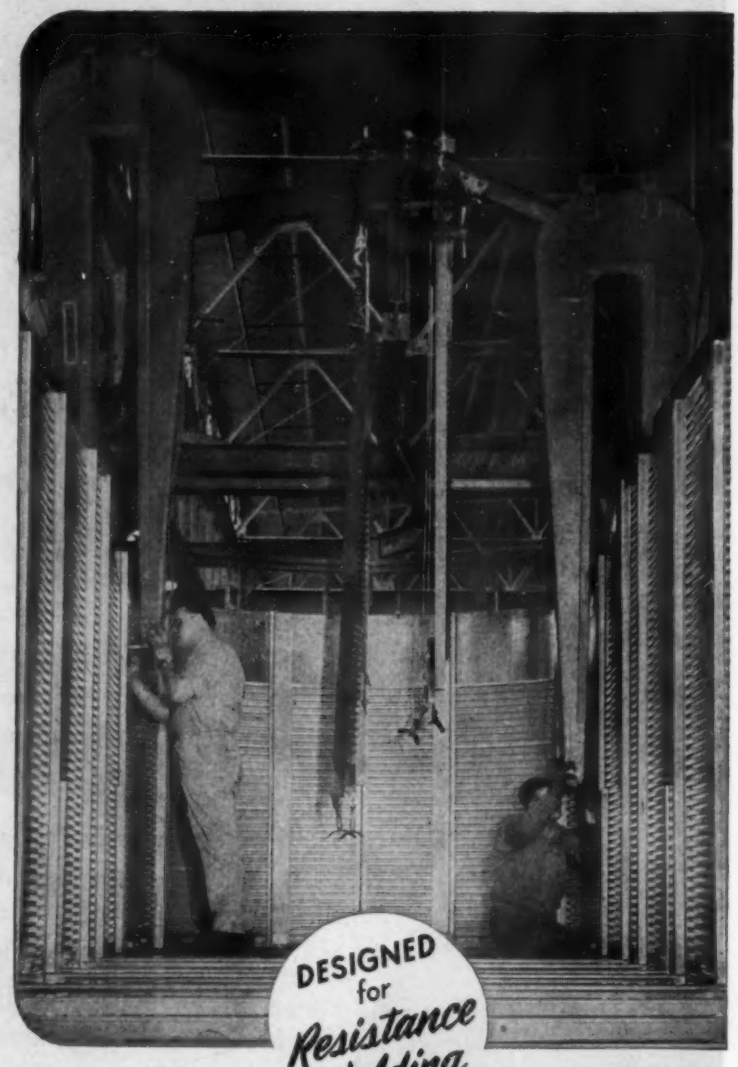
There really wasn't any other way to design them—



When Fruehauf designed its now famous stainless steel truck-trailer it went after real mass production: not just a couple of hand assembled trailers a day—but a complete trailer off the line every 45 minutes.

There were two ways to do a job like that. Either Fruehauf could build enormous plants with many assembly lines and use relatively slow equipment—or it could design the trailers for assembling by resistance welding from stem to stern, from roof to undercarriage.

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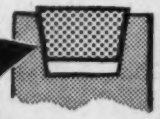
RESISTANCE WELDING EQUIPMENT

It's the SIDE OF A V-BELT that DOES the WORK! and GETS the WEAR!

V-Belt In Sheave



Clearly, it's the sides of a V-Belt that do all the gripping on the pulley and get all the wear against the sheave-groove wall. That's why longer life for the sides means longer life for the belt!

That's Why the CONCAVE SIDE is IMPORTANT!

(A GATES PATENT)

Look at any V-Belt in its sheave groove and you *see at once* that the sidewall is the part that gets the wear!

The *sidewall* is what grips the pulley. The sidewall picks up the power from the driver pulley, transmits that power to the tension member, then grips the driven pulley and transmits the power to it!

That explains why you have always noticed that the sidewall of the *ordinary* V-Belt is the part that wears out first. Clearly, anything that lengthens the life of the sidewall will lengthen the life of the belt.

The simple diagrams on the right show exactly why the ordinary, *straight-sided* V- Belt gets excessive wear along the *middle of the sides.* They show also why the Patented Concave Side *greatly reduces* sidewall wear in Gates Vulco Ropes. That is the simple reason why your Gates Vulco Ropes are giving you so much longer service than any straight-sided V-Belts can possibly give.

Straight Sided V-Belt

How Straight Sided V-Belt Bulges When Bending Around Its Pulley

You can actually feel the bulging of a straight-sided V-Belt by holding the sides between your finger and thumb and then bending the belt. Naturally, this bulging produces excessive wear along the middle of the sidewall as indicated by arrows.

Gates V-Belt with Patented Concave Sidewall

Showing How Concave Side of Gates V-Belt Straightens to Make Perfect Fit in Sheave Groove When Belt Is Bending Over Pulley

No Bulging against the sides of the sheave groove means that sidewall wear is evenly distributed over the full width of the sidewall—and that means much longer life for the belt!

4611

MORE Important NOW Than Ever Before!

Now that Gates Specialized Research has resulted in V-Belts having much stronger tension members—tension members of Rayon Cords and Flexible Steel Cables, among others—the sidewall of the belt is often called upon to transmit to the pulley much heavier loads. Naturally, with heavier loading on the sidewall the life-prolonging Concave Side is more important today than ever before!

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World's Largest Makers of V-Belts

Gates

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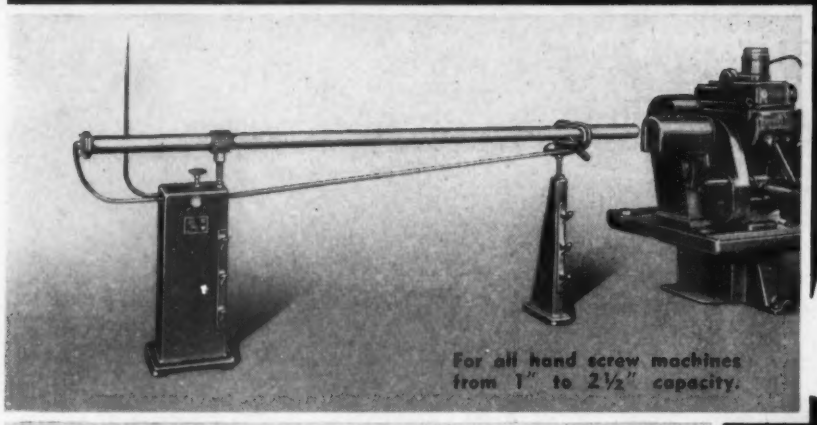
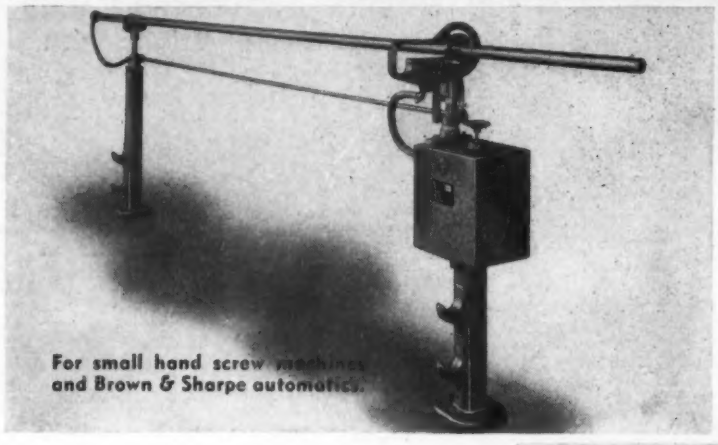
Engineering Offices and Jobber Stocks **IN ALL INDUSTRIAL CENTERS** of the U. S. and 71 Foreign Countries

Proved in Service! LIPE BAR-FEEDS



For all hand screw machines from 1" to 2½" capacity.

GIVE 20% GREATER SCREW MACHINE OUTPUT *in the simplest or the most complicated operations*



For small hand screw machines and Brown & Sharpe automatics.

DEVELOPMENT after development, built on the success of Lipe Pneumatic Bar Feeds in the hands of the most exacting production men, have provided units suitable for the smallest to the largest screw machine—hand operated or automatic. Over a wide range of screw machine or turret lathe work, all these advantages can now be made use of, in modernizing your production methods.

- Saves up to 20 minutes per 12 ft. bar.
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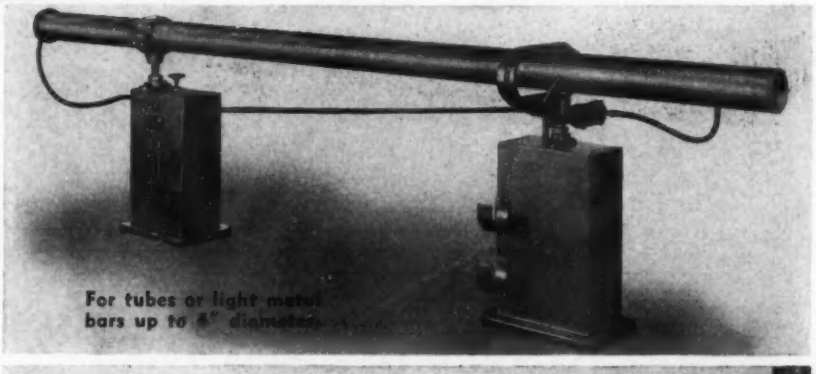
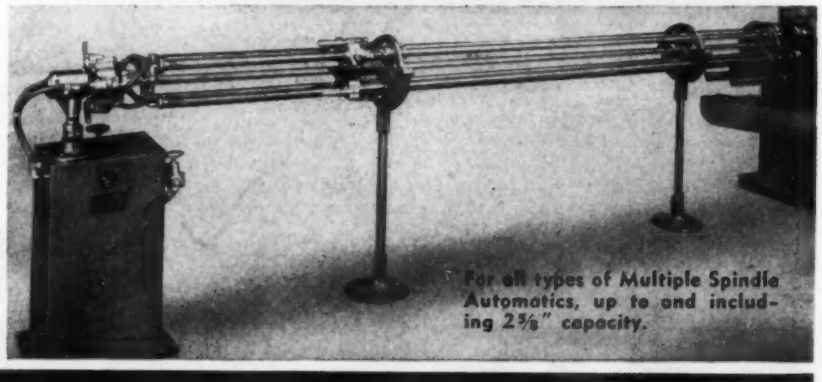
- Handles exact-size polished stock without marring or scratching.
- No noise — safe — bar completely enclosed.
- Reduces scrap loss.
- Quickly reloaded with a single motion.



For tubes or light metal bars up to 4" diameter.

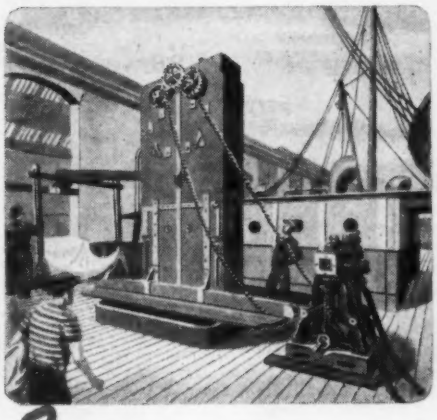


For all types of Multiple Spindle Automatics, up to and including 2⅝" capacity.

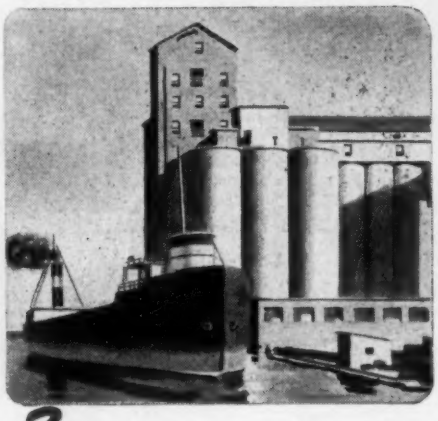
Throw away your feed fingers . . . and pushers. See how you can get rid of complications . . . and save money. Write today for complete descriptions and engineering data.

Lipe-ROLLWAY CORPORATION, Syracuse 1, N. Y., U.S.A.
Cable Address: LIPEGEAR

1 Early American settlements had community granaries like those of Biblical times for winter storing of grain. In 1834, the first modern grain elevator was built in Buffalo. By 1866, bulk handling of grain was an established industry.



2 Chains of buckets were run, by cumbersome ropes and countershafts, from one central power source on the ground floor. In 1896 came the biggest improvement to date—individual motors were developed to drive each conveyor unit separately.



3 Today, with electrical horsepower, a Buffalo grain elevator can unload grain from lake carriers at the rate of 85,000 bushels an hour. Howell has been building specialized motors for grain elevators and other industries since 1915.

Have you a hard job for Horsepower?

Perhaps you have a process where extremely high or low temperatures exist—excessive moisture—high starting torque—or just a real tough job for a motor. Then get a protected industrial type motor that's built to "take it."

Here's why industrial type Howell Motors stand up:

(1) Precision-built of finest materials, with copper or bronze rotors, and completely insulated.

(2) Smooth-operating because statically and dynamically balanced.

(3) Designed for the toughest tasks in industry—consequently better-performing on *all* jobs.

See your nearest Howell Representative for your needs in specialized or standard motors up to 150 h.p. Remember, you pay no more for industrial type Howell Motors—and you always get top quality for your money.

Howell Protected Type Motors available in sizes 5 h.p. and smaller. Also other sizes of Howell industrial type motors available up to 150 h.p.

HOWELL MOTORS

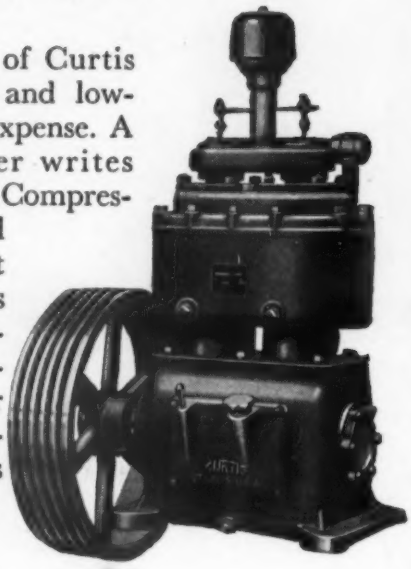
HOWELL ELECTRIC MOTORS CO., HOWELL, MICH.

Manufacturers of Quality Industrial Type Motors Since 1915

CURTIS
AIR COMPRESSOR

Operates 14,000 Hours with Maintenance of Less than $75!

Here's proof of Curtis dependability and low-maintenance expense. A Nebraska user writes about a Curtis Compressor purchased in 1926 that "14,000 hours of operation resulted in an expenditure for repairs, including labor, of less than $75!"



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- Timken-bearing equipped
- Carbon-free disc-valves
- Self-oiling — positive-pressure lubrication
- Parts readily accessible and interchangeable
- Electric motor or gasoline-engine driven
- Automatic pressure-unloader
- Precision construction throughout

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Also, learn how Curtis Air Hoists offer a faster and smoother performance of hoisting, lowering, pushing or pulling.

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PRODUCTION METHOD No. 1
Metal Spinning of your
FORMED PARTS AT LOW COST IN ALL DUCTILE METALS

METALS	THICKNESS	DIAMETERS	
Stainless Steel	to ¼"	to 6'	Difficult shapes. No seams or ridges. Smooth clean surface. No waiting for complicated dies.
Monel	to ¼"	to 5'	
Aluminum	to ½"	to 10'	
Copper	to ½"	to 6'	

Whether your requirements are for two or three experimental parts or for thousands of intricate Bergfels spun mass produced parts—your tool costs are negligible; production is rapid; Tolerances are exact.

Our complete facilities include spinning, deep drawing, stamping, silver soldering, brazing, welding, fabricating and assembling departments. Our record of accomplishments in pioneering the spinning technique, leaves no metal forming or spinning problem that is beyond the "know-how" of our specially skilled metal craftsmen. Our engineering department is always available for consultation, call us.

Facilities for deep drawing—including a 400 ton hydraulic press.

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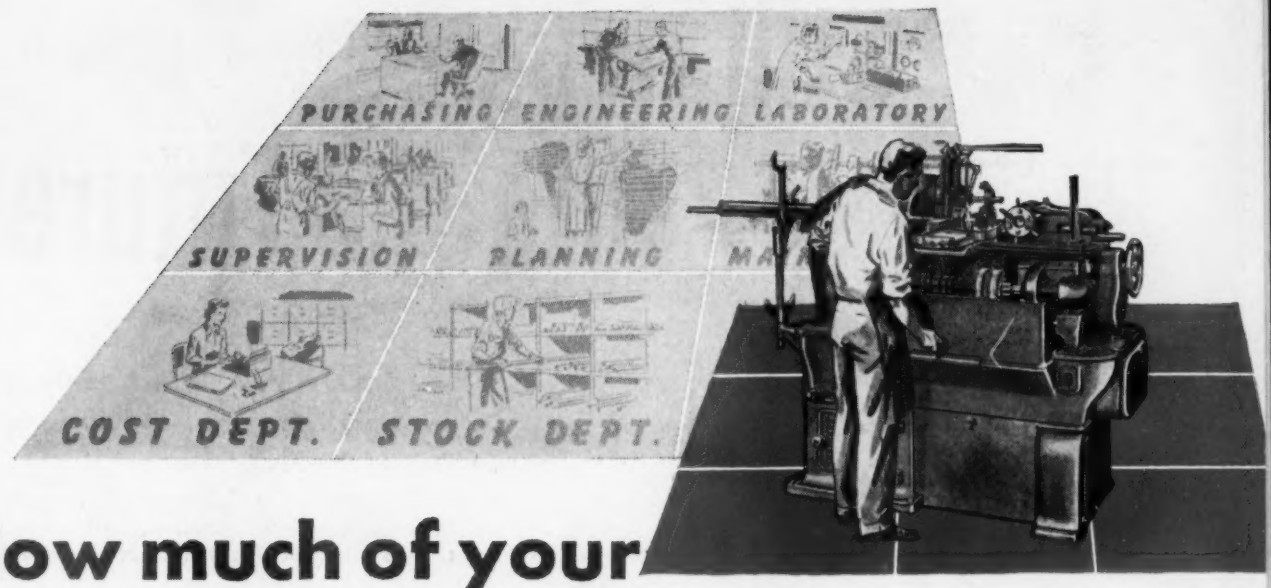
Metal Spinning

TO EXACT TOLERANCES . . . IN STAINLESS STEEL, MONEL METAL, ALUMINUM, COPPER AND ALL DUCTILE METALS



How much of your Overhead Shadow can you charge to Profit—*and Loss?*

Your overhead shadow is always with you. When it falls across a "simple screw machine job" that you could buy outside, it can easily make the operation look like a "loss leader."

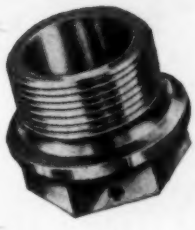


Figure it out: Suppose you need some special part for your assemblies. You have a few automatics and the men to run them, so you make the parts. Your Purchasing Agent buys the bars — Engineering lays out the detail — Laboratory tests samples of stock and output — Supervision sets up the jobs — Planning schedules them — Maintenance keeps things running — Cost Dept. makes special entries — Stock Dept. has raw material as well as finished product to keep track of — and your too-busy Tool Room has extra work to do!

Now look at this side: You send your blueprints and specifications to CORBIN SCREW. We can reproduce exactly as specified — or possibly we can suggest changes in design, stock and method to improve quality, performance, or cut costs. We manufacture in a plant equipped with thousands of metal-working machines including headers, screw machines, grinders, thread rollers . . . we inspect and deliver according to schedule . . . and the economy is evident when you consider your cost *plus overhead.*

Your Overhead Shadow is always with you. Why not use it only where it's needed? Let's talk it over.

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The American Hardware Corporation
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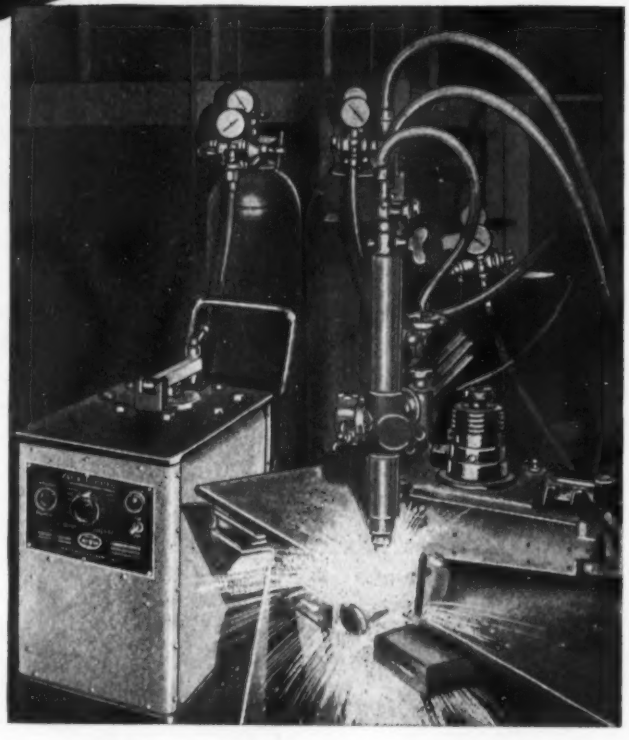
Still looking into the Future

YESTERDAY... Punch, snip or melt ... a grueling grind for the cutting of Stainless Steels

Yesterday cutting stainless steel by melting-away or shearing was slow...costly...and with the carbon arc the resulting surfaces were rough and unsightly.

TODAY... It's the oxyacetylene flame for production cutting of Stainless Steels

Today, Airco's new Flux-Injection Method of stainless steel cutting is time-saving and economical. With this new process, stainless steels with alloying elements as high as 50% can be oxyacetylene flame cut as readily as ordinary steels. Used with Airco oxyacetylene equipment, this new method keynotes simplicity and economy. In fact, operating conditions and instructions for stainless steel cutting approximate those for mild steel, and "cut speed" is comparable.



AND TOMORROW . . . ?

Airco's research and development staff will continue to work in this and other fields of metal working to contribute new and better oxyacetylene flame methods... creating the techniques and tools of tomorrow. Moreover, the facilities of our Technical Sales Division are available to all metal working men in applying Airco processes to the solution of their problems.

For more information about stainless steel cutting, write for a copy of "Flux-Injection Method Brings Economies of Oxyacetylene Flame Cutting to Stainless Steel". Address your nearest Airco office, or write: Air Reduction, General Offices, 60 East 42nd Street, New York 17, N. Y. In Texas: Magnolia Airco Gas Products Company, General Offices, Houston 1, Texas.

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"I amazed our board when I showed them a 55% savings in material handling"
TURNS OVERHEAD INTO PROFITS
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Installation of a Wheelabrator Swing Table at the Ottumwa Iron Works, Ottumwa, Iowa, has resulted in a 25 per cent cut in cleaning costs on mine hoist parts.

The Wheelabrator replaced a large tumbling barrel which was operating 24 hours a day, and by eliminating much of the hand work, reduced the cleaning time to 4 minutes per table load. Equipped with a 66" diameter work table, the Wheelabrator cleans hoist drums, mine car wheels, gear housings and machine brackets. Castings up to 800 pounds are handled in the machine.

The Swing Table also gives the castings a better appearance, makes for easier machining and permits quick inspection, due to complete removal of all sand and scale right down to the virgin metal.

The Wheelabrator Swing Table, a new American development, is designed to meet the need for moderately priced equipment capable of handling a wide range of large and small pieces where daily production does not warrant the purchase of several types of cleaning apparatus. It can be furnished with a 24", 66", 72", or 86" diameter work table.

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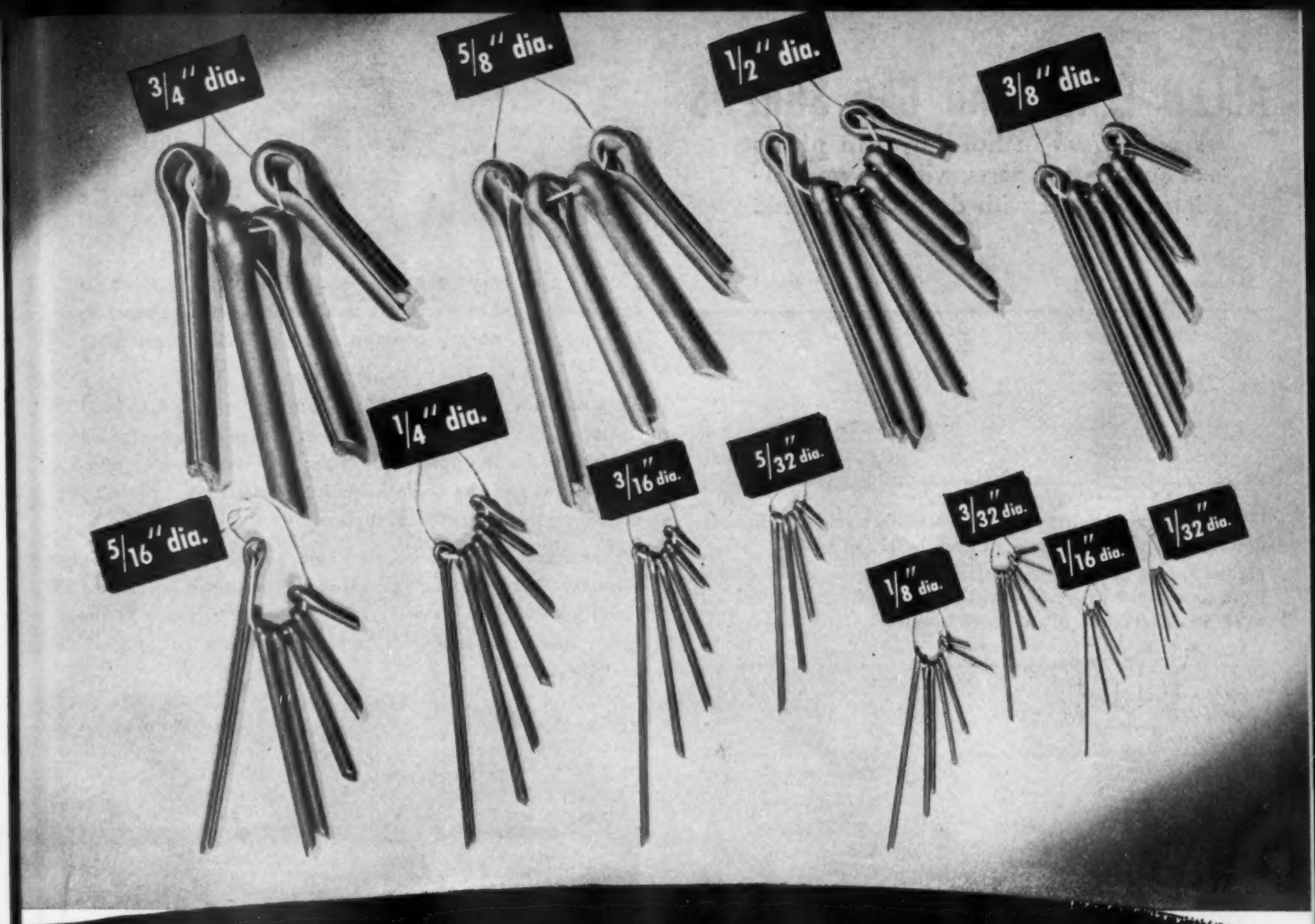

COTTERS . . FROM 1/32" x 1/4" TO 3/4" x 24"

along with your bolts and nuts

Our customers find it convenient to obtain bolts, nuts and cotters from the same source —in one shipment and on one bill of lading.

In addition to a full line of steel and brass cotters, Lamson & Sessions produces cotters made of bronze, stainless steel and aluminum alloys, made to your specifications *in production quantities.* Our extraordinary volume production of cotters is maintained by a large battery of machines designed and built exclusively for Lamson & Sessions.

The wire for Lamson cotters is cold rolled in our own plants, insuring control of both size and quality from raw material to finished product. Modern chemical, metallurgical and physical testing laboratories are maintained to insure uniformity of specifications in both standard cotters and those made "special".

The Lamson "Efficiency" point actually speeds up assemblies because of the diagonally cut points, one of which is longer than the other. This type cotter serves as a drift pin in aligning parts. A blow of a wrench or twist of pliers on the point of the longer shank spreads shanks apart quickly. Your jobber can supply you with Lamson cotters out of stock.

THE LAMSON & SESSIONS COMPANY, 1971 W. 85th St., Cleveland 2, Ohio

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OS · STOVE BOLTS · SHEET METAL SCREWS · WIRE ROPE CLIPS · PIPE PLUGS · WEATHER-TIGHT BOLTS · MACHINE SCREWS AND NUTS · SPECIALS

ALLEN FLAT HEAD CAP SCREWS

set up *flush* in holding thin plates or superposed parts, without weakening the metal with deep countersink.

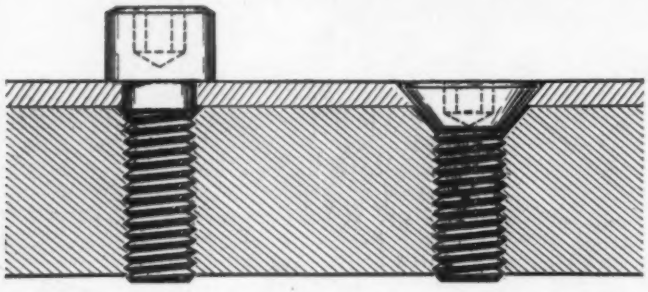
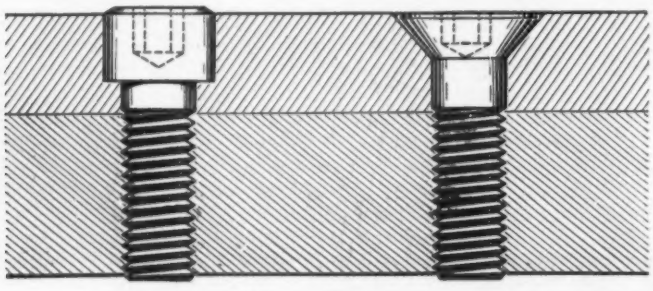


Figure 1, above, (right) shows flush surface achieved in tieing down metal piece thinner than head height of screw.

Figure 2, below, shows advantage in fastening relatively thin plate to retain flush surface without weakening the metal with deep countersink. Note more binding surface under head.



ALLEN USAGE

Here's the way to apply ALLEN holding-power to comparatively thin plates where a flush top surface must be achieved, with no gap between screw head and surrounding metal.

Note that top piece of metal in Figure 1 is thinner than head height of the Flat Head Cap Screw. There's more binding surface under the head than is the case with a projecting-head screw, and the angle helps lock the screw in place by drawing down on a conical surface.

Figure 2 shows application in a comparatively thicker plate. Here the flush surface is retained without weakening the metal with a deep countersink. Maximum strength in the screw itself is assured by "pressur-forming" of special-analysis ALLENOY steel.

Your local Allen Distributor will supply you with samples to try out these signal advantages of our Flat Head Cap Screws. Ask him or write us. Engineering data on request.

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New Advantages

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No. IG	INTERNAL GRINDER	**No. 34**	VERTICAL SPINDLE SURFACE GRINDER
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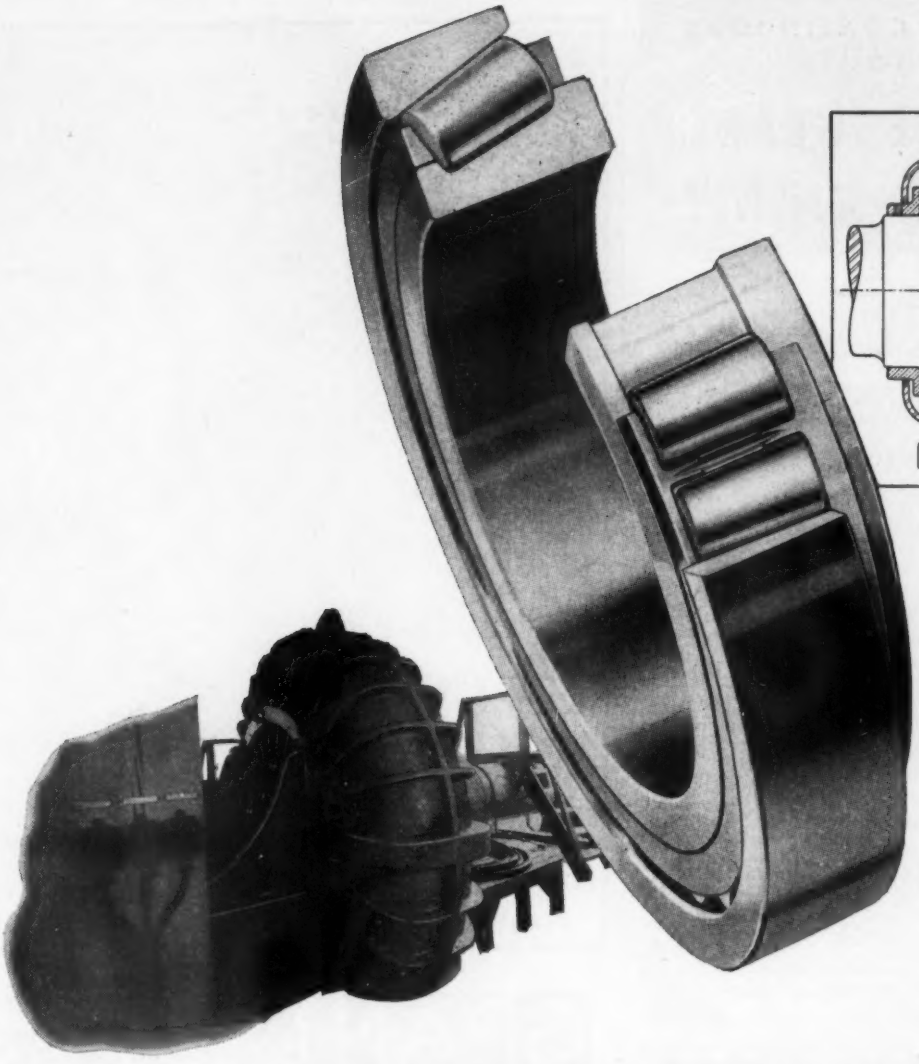

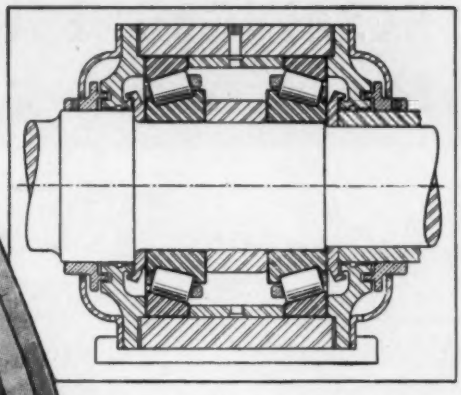

Cross-section shows two of the Torrington single-row tapered roller bearings as used at the Fort Peck Dam in the 28" Bucyrus-Erie Dredge Pumps.

CARRYING PUMPING LOADS AT FORT PECK DAM

In 1934, dredge pumps manufactured by Bucyrus-Erie Company of South Milwaukee, Wisconsin, were used at the Fort Peck Dam. Two high-capacity Torrington Tapered Roller Bearings were specified to carry the heavy combined radial and thrust loads imposed by the 28" diameter (discharge) pumping units, each driven by a 2500 h.p. motor at 253 r.p.m. full load speed.

Design and manufacture of large, custom-built, anti-friction bearings for heavy-duty service on engineering projects and on the machinery of the steel, paper, oil, machine tool and other industries is an important function of Torrington's Bantam Bearings Division. The specialized knowledge and cooperation of Torrington engineers are at your disposal; don't hesitate to call on them to help on any anti-friction problem, routine or unusual.

THE TORRINGTON COMPANY • BANTAM BEARINGS DIVISION
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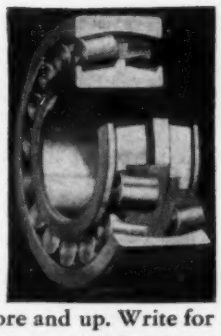
THE TORRINGTON SELF-ALIGNING SPHERICAL ROLLER BEARING



This latest addition to the Torrington line is a self-aligning bearing, specifically adaptable for heavy-duty performance. Sizes will be available to cover a complete range from 1.5748" bore and up. Write for further details or see your nearest Torrington Representative.

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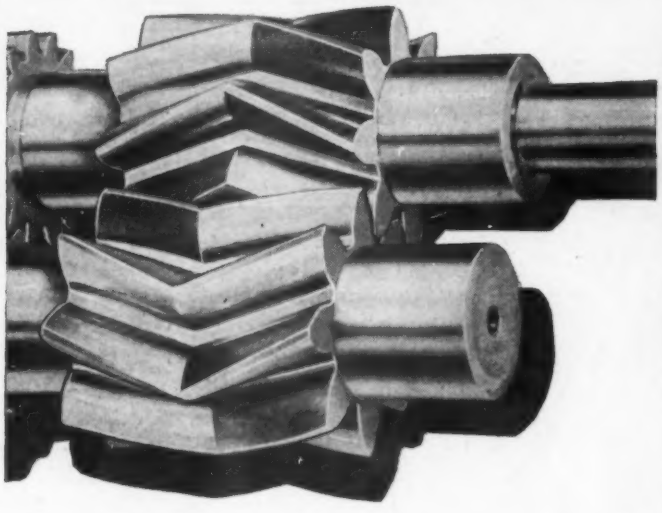
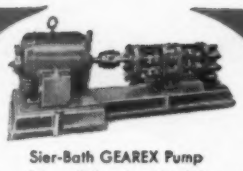
SIER-BATH CONTINUOUS TOOTH HERRINGBONE GEARS Have to be Right!



We Are Our Own Most Exacting Customer!



Sier-Bath GEAREX Pump
Internal Bearing Model

● Sier-Bath Continuous Tooth Herringbone Gears, generated by the Sykes Method, provide smooth power flow. The load is distributed uniformly on each tooth and across the entire face. Axial thrusts are balanced by the opposing helices which meet to form continuous teeth, providing extra strength and high load carrying capacity in small space. We were our own first customer for these gears. The new Sier-Bath GEAREX Pump is designed to employ continuous tooth herringbone timing gears and rotors . . . thereby giving us a continuous check upon their performance in actual service. Let Sier-Bath quote on your continuous tooth herringbone gears.

GEAR RANGE Spur, helical and worm gears to 48" Dia. 3 D.P. and finer; straight tooth bevel gears 32 pitch to 3 pitch. Gears shaved from 1" to 24". Continuous Herringbone Gears generated by Sykes Method up to 37" O.D. Worms and threads precision ground on J. & L. Thread Grinder to extremely close tolerances. Spur and helical gear grinding up to 10" diameter.

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Do you need gears—spur, helical, worm or bevel, of cast iron, steel, bronze or composition? Foote Bros. has been making gears for almost a century—giants 20 feet in diameter to midgets you can hold in one hand.

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Wide experience, broad line and complete facilities make Foote Bros. your No. 1 source for power transmission equipment.

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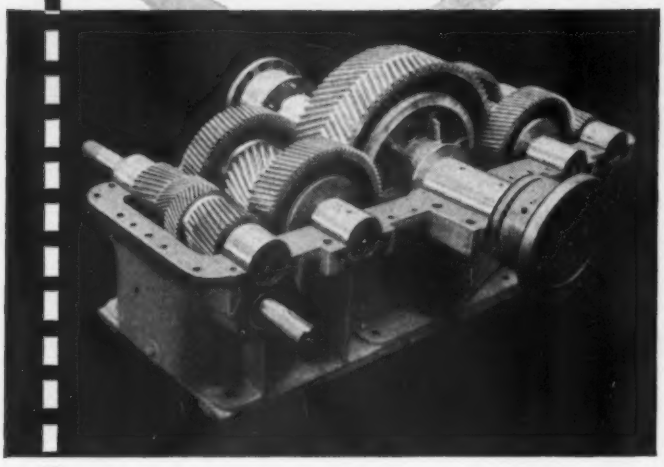
what about sykes gears?



We're in a position to furnish quick deliveries on Sykes gears which are made to EARLE standards and to your specifications. For medium and heavy machinery—where precision, smoothness, strength and economy are essential—EARLE Sykes-Type Gears lead the field.

And here's why. They're *precision* cut—and maintain precision operation. They're *smooth*—insure constant and uniform transmission of power by distributing the load across the entire gear face. They're *strong*—built ruggedly, for long life. They're *economical.* Let us quote you on your needs—for Sykes, as well as spurs, helicals, herringbones, worms, or racks.

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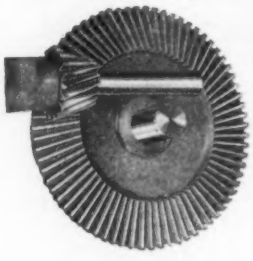

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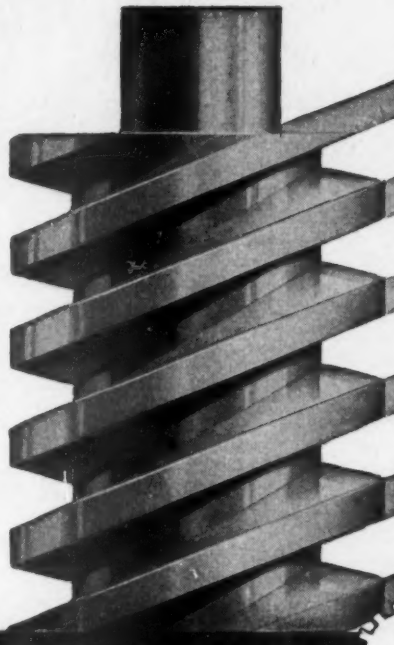

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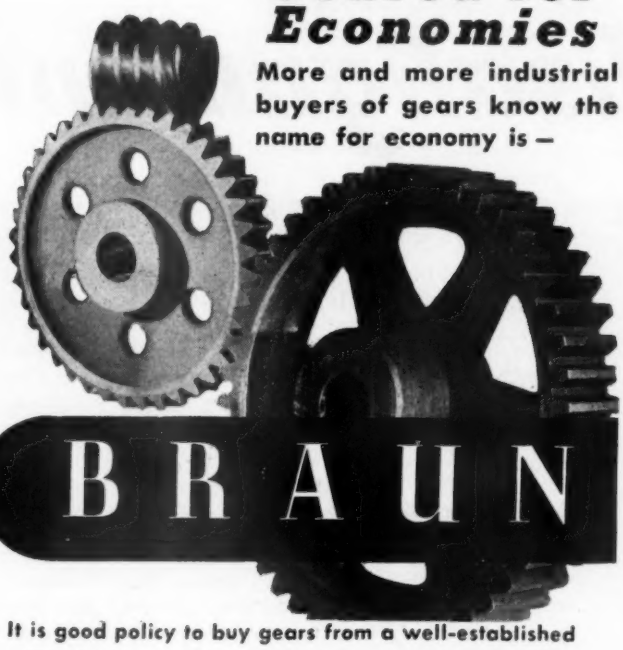
More and more industrial buyers of gears know the name for economy is —



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It is good policy to buy gears from a well-established organization with a modern completely equipped factory. Braun has the facilities and experience of 38 years in manufacturing large orders of gears. Send your prints to Braun for estimates without obligation.

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Follow the leaders . . . for they know the way! *Cincinnati Gears, Good Gears Only* are the choice of industry wherever outstanding performance is important.

Cincinnati precision made gears have the built-in strength, stamina, accuracy . . . everything, that long range performance must have to lower costs and increase profits. Remember, each Cincinnati Gear is made for your particular job . . . from your specifications.

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Here's how Falk Steelflex Couplings completely protect connected machinery

from *Shock...* *Vibration...Misalignment*

Only Falk Steelflex Couplings provide all three: Flexibility, Torsional Resilience* and Applicability to 90% of all industrial requirements.

These three factors are important to the coupling buyer. They offer him positive protection to connected machinery . . . the certain solution to applications where shock loads, misalignment and vibration are problems . . . and the opportunity of stocking one type of coupling to meet practically all of his coupling requirements, quickly and conveniently.

How Falk Steelflex Couplings are designed and produced to provide these factors is important. The diagrams on the opposite page explain how the Falk "grid-groove" design functions to protect machinery against ordinarily damaging conditions . . . how it compensates for parallel and angular misalignment and permits free end float.

A simplified method for selection, load classifications, service factors and dimensions is available to you in a booklet. You are enabled to meet your requirements dependably, quickly —with a reduced parts inventory.

In addition to the standard Type "F" which is applicable to more than 90% of all installations, Falk offers a line of large Steelflex couplings and couplings featuring the Steelflex principle but used for special service and dual-purpose applications.

Get the complete information on Falk Steelflex Couplings either from your Falk representative or distributor, or write to Falk.

*** Torsional Resilience is the ability to spread the peak or shock loads over a relatively long increment of time, thereby greatly reducing stresses in the connected machinery.**

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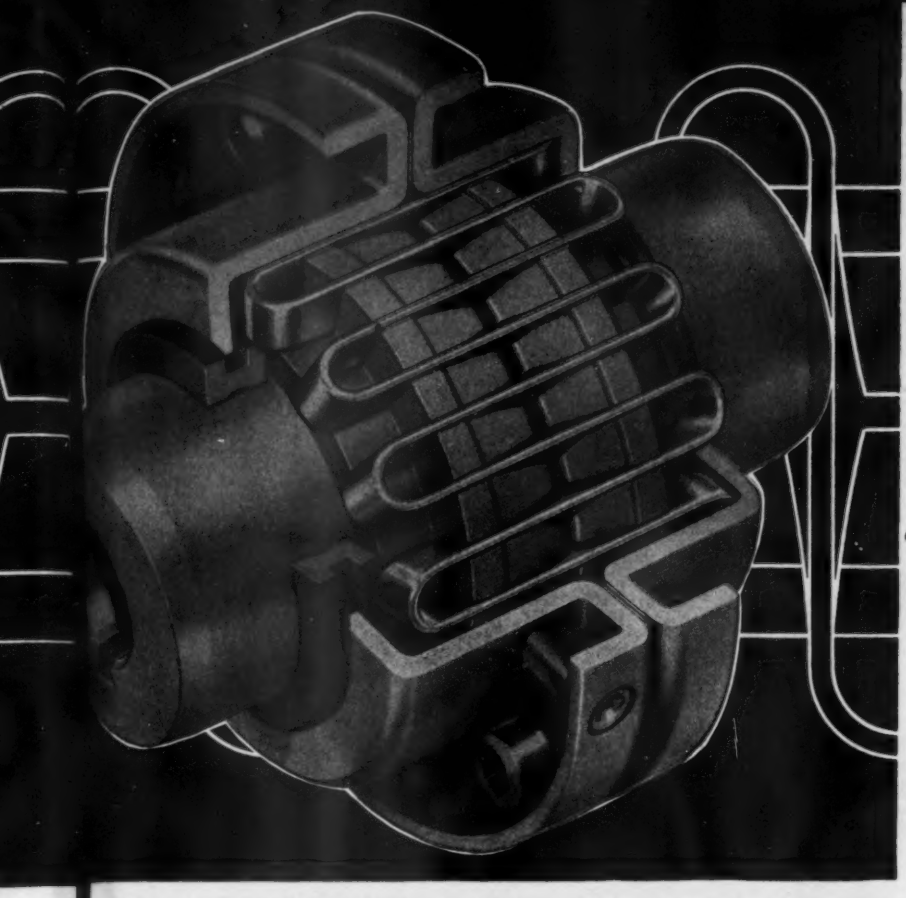
For over fifty years precision manufacturers of Speed Reducers . . . Motoreducers . . . Flexible Couplings . . . Herringbone and Single Helical Gears . . . Heavy Gear Drives . . . Marine Turbine and Diesel Gear Drives and Clutches . . . Steel Castings . . . Contract Welding and Machine Work. District Offices, Representatives, or Distributors in principal cities.



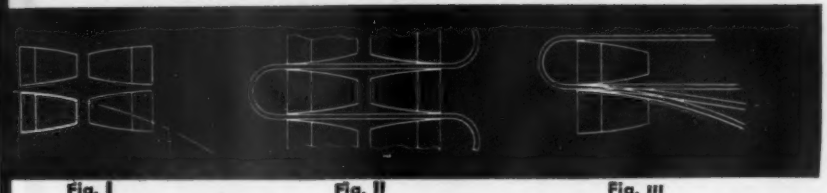
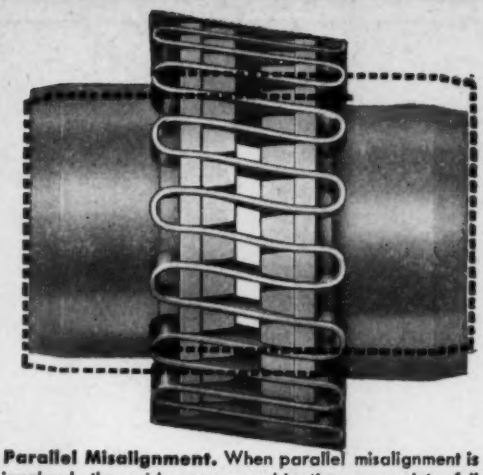


Fig. I Fig. II Fig. III

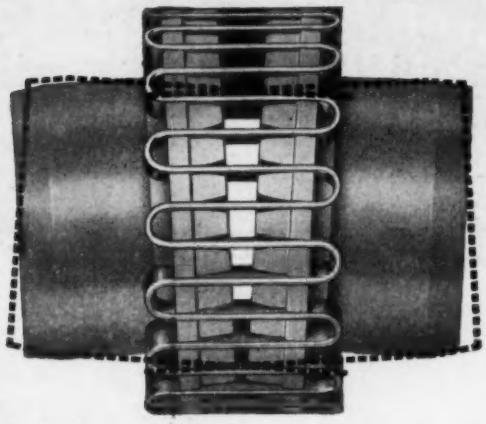
Fig. I. Grooves, in a precise arc, and with a radius and length proportional to the capacity of the coupling, are cut into two identical hubs of moderately high carbon steel—forged of Falk alloy cast steel . . . Fig. II. These grooves provide a slot for a grid member made of chrome alloy steel with an elastic limit of 180,000 pounds per square inch and an ultimate strength of 220,000 pounds per square inch . . . Fig. III. This grid fits snugly into the curved grooves cut into the hubs of the coupling. The grooves provide a scientifically set bearing surface for the grid. This bearing surface extends from the outer to the inner edge of the grooves. The grid bears on the grooves in proportion to the load . . .

Fig. IV Fig. V Fig. VI

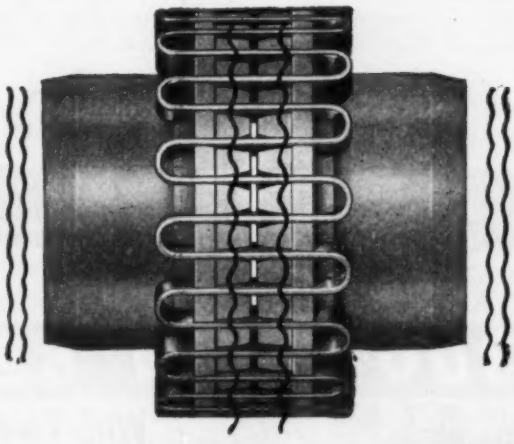
Fig. IV. Under light loads, the grid bears only at the outer edges of the grooves. This permits a long, free, elastic span between the outer edges of both hubs. Power is transmitted through almost the entire length of the grid rung . . . Fig. V. Under normal loads, the grid bears on a larger area of the grid grooves and the span of the grid run is shortened. It transmits more power and maintains its capacity to absorb shocks and dampen vibration . . . Fig. VI. Under peak loads, the grid rungs bear over almost all of the curved surfaces of the grooves. The span of the grid rung becomes very short. Under the impact of shock loads the grid flexes and continues to transmit power smoothly.



Parallel Misalignment. When parallel misalignment is involved, the grid-groove combination comes into full play. The movement of the grid in the lubricated grooves accommodates the misalignment, while still permitting full functioning of the grid-groove action of the coupling in absorbing shock and dampening vibration.



Angular Misalignment. Under angular misalignment the design of the Falk Steelflex Coupling permits a rocking and sliding action of lubricated grid and hubs that allows the greatest freedom of accommodation to angular misalignment, while at the same time transmitting the power through the resilient grid.



Free End Float. Because the grid member slides freely in the lubricated grooves, the Steelflex coupling permits unrestrained end float for the shafts of both the driving and driven members, or of either one. If it is desired that end float be restricted, provision can be made to limit it to any required amount.

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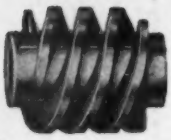
"HARTFORD" for Gears, Cams, Thread-Grinding



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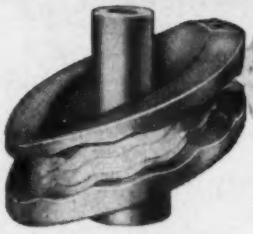

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STRAIGHT SIDE SINGLE CRANK PRESSES
for heavy blanking and forming

Heavier classes of blanking and forming work can be handled efficiently and economically on these presses.

Sturdily constructed with either solid frame or built up with tie rods. Small elastic deflections do not affect tool alignment. All stresses taken centrally. Made also with wedge adjustment for slide for very close work.

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300 TWIN BENDS *per hour!*

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This is but one example of how DI-ACRO precision machines—Benders, Brakes and Shears—can accurately and economically duplicate a great variety of parts, pieces and shapes, without die expense. **Write for Catalog—"DIE-LESS DUPLICATING"**

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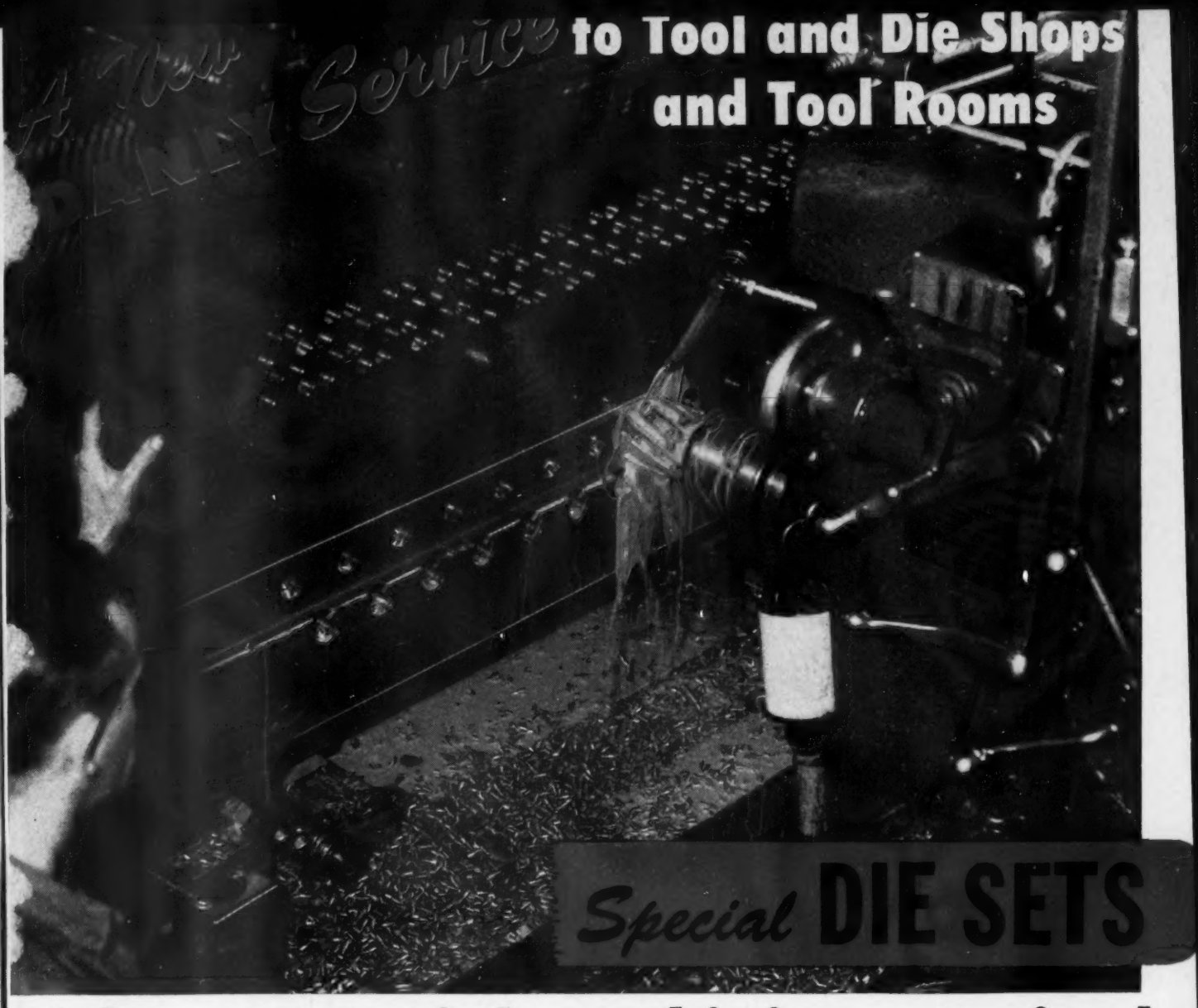

with any special machining required

So many customers have requested additional machine work on special die sets, that such service is now made generally available.

Complete equipment is installed to do any desired machine work to the customer's specifications on any special die set made by this company including M-K & A-S sets, as listed in general catalog.

These special die sets may now be delivered completely machined ready for the mounting of the die. This service saves time, as the work on the die and the die set can proceed simultaneously.

It permits the die shop or tool room to devote their equipment and man hours to the making of dies.

This service also solves the problem of the handling of big sets, for which the die shop or tool room may not have the machining or handling equipment to perform the necessary work economically.

We would like to know what you think of this new Danly Service to the tool and die shops and tool rooms of America. On your next special die set inquiry include the additional machining work that you believe could be advantageously handled "on the outside." The cost of such machining will be shown as an individual item in the quotation.

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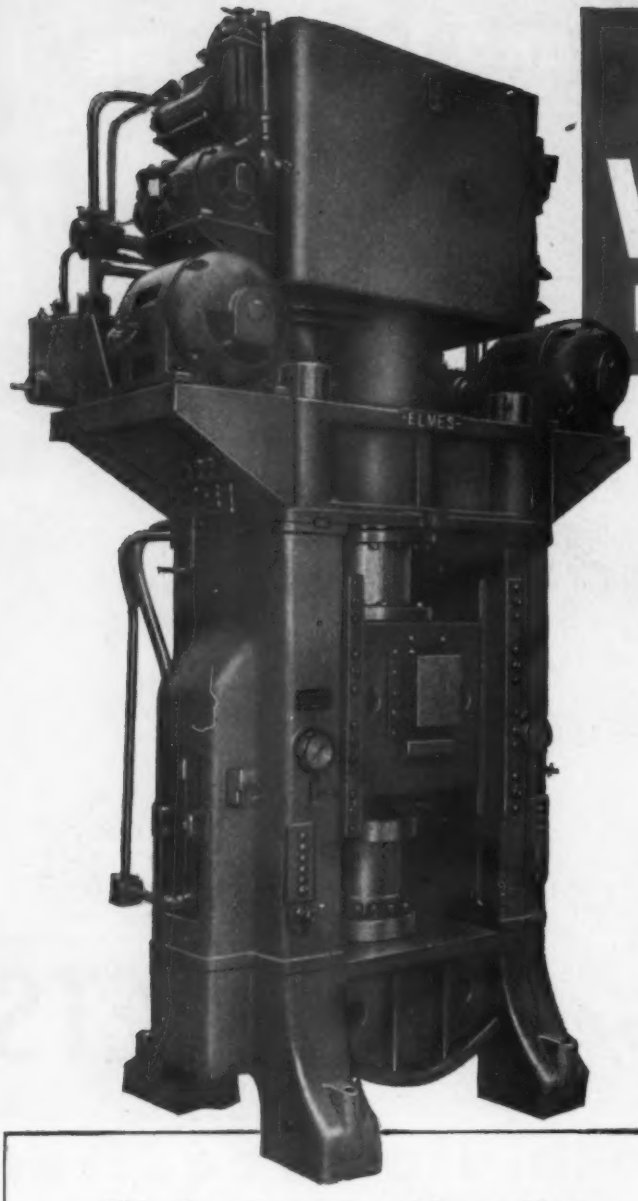
DANLY *Special* DIE SETS

MACHINED TO YOUR SPECIFICATIONS



Here's VERSATILITY IN FAST PRODUCTION PRESSES

Say "good-by" to the *one-job* press. Now, Elmes ingenuity brings you a metal working press so versatile it *does everything* with speed and ease.

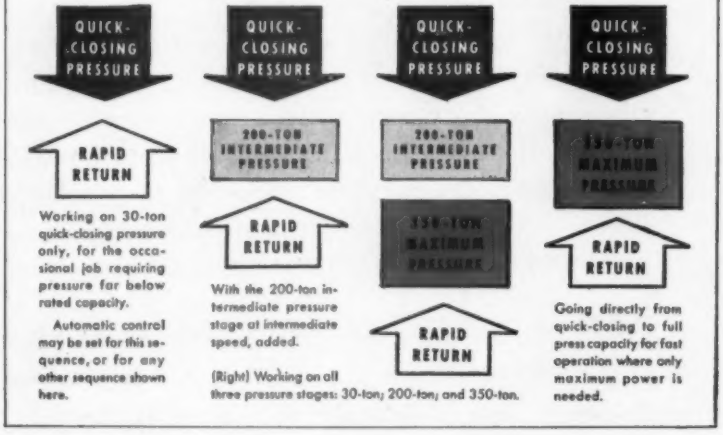
Flexibility—in setting, in control, in performance—gives this new Elmes press *production-shop* speed with *job-shop* versatility. Stroke can be as little as 3". Pressure can be reduced to as low as 1/7 to 1/10 of rating. Yet full force can be exerted at *any point* in the stroke. Fast travel makes the operating cycle short.

The quick-closing ram slows to pressing speed at *any* selected point in travel, or upon light contact with the piece. Automatic slide reversal is actuated either by ram travel or pressure—even when *"inching"* at pressing speed, or slower. On "production control," and stopped in mid-cycle by the "stop" button, the press may be started again in *either direction*—an excellent feature when developing new blanks.

Made in single- and double-action types, with or without cushion, in capacities from 25 to 5000 tons. Illustrated: the 350-ton size with pressure sequences as shown. This particular press has 150 tons on the ram return for *extra-heavy* stripping.

If *you* work metal in variety or volume, this new Elmes press offers you many advantages. We'll be glad to give you all the facts.

This One Press Provides a Choice of These 4 Operating Cycles ...ALL ON AUTOMATIC CONTROL



Working on 30-ton quick-closing pressure only, for the occasional job requiring pressure far below rated capacity.

Automatic control may be set for this sequence, or for any other sequence shown here.

With the 200-ton intermediate pressure stage at intermediate speed, added.

(Right) Working on all three pressure stages: 30-ton; 200-ton; and 350-ton.

Going directly from quick-closing to full press capacity for fast operation where only maximum power is needed.

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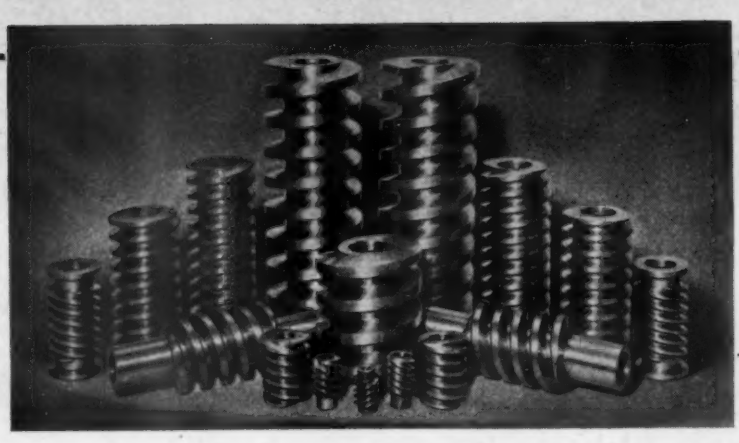

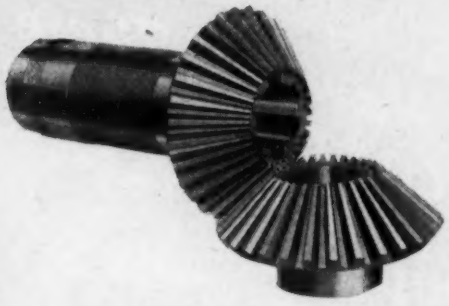

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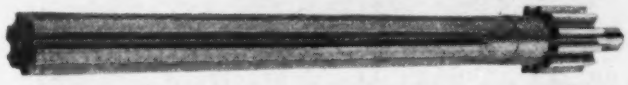

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For INDUSTRY

Since 1888 . . .

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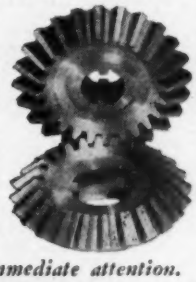

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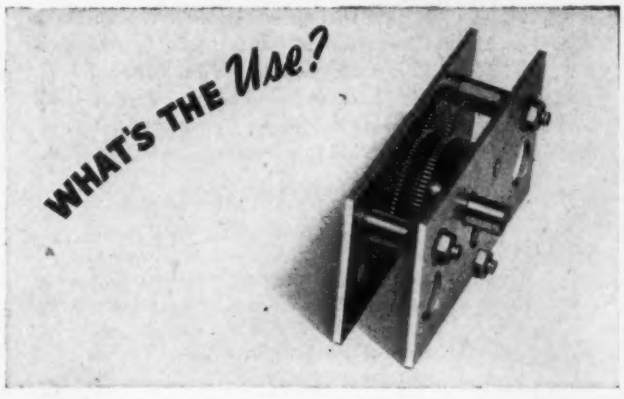

In selecting the *right* gears for the job, it is important to know how they will be used — the conditions under which they must operate.

Beaver Gear Engineers, knowing what is expected, and trained to assist in details of fine-pitch gear applications, can tell you what will work best under various conditions and can specify the correct design.

Beaver modern production facilities and experienced craftsmen assure you of gears made correctly to specifications.

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SQUARING SHEARS • ARBOR PRESSES • FOOT PRESSES

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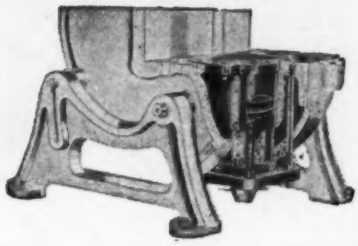
=DAYTON ROGERS DIE CUSHIONS

No matter how you figure it Dayton Rogers Die Cushions will assure better results and lower production costs on your punch press operations because:



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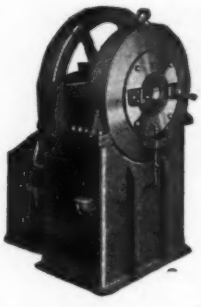

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WILLIAM F. BREWER MACHINE CO.
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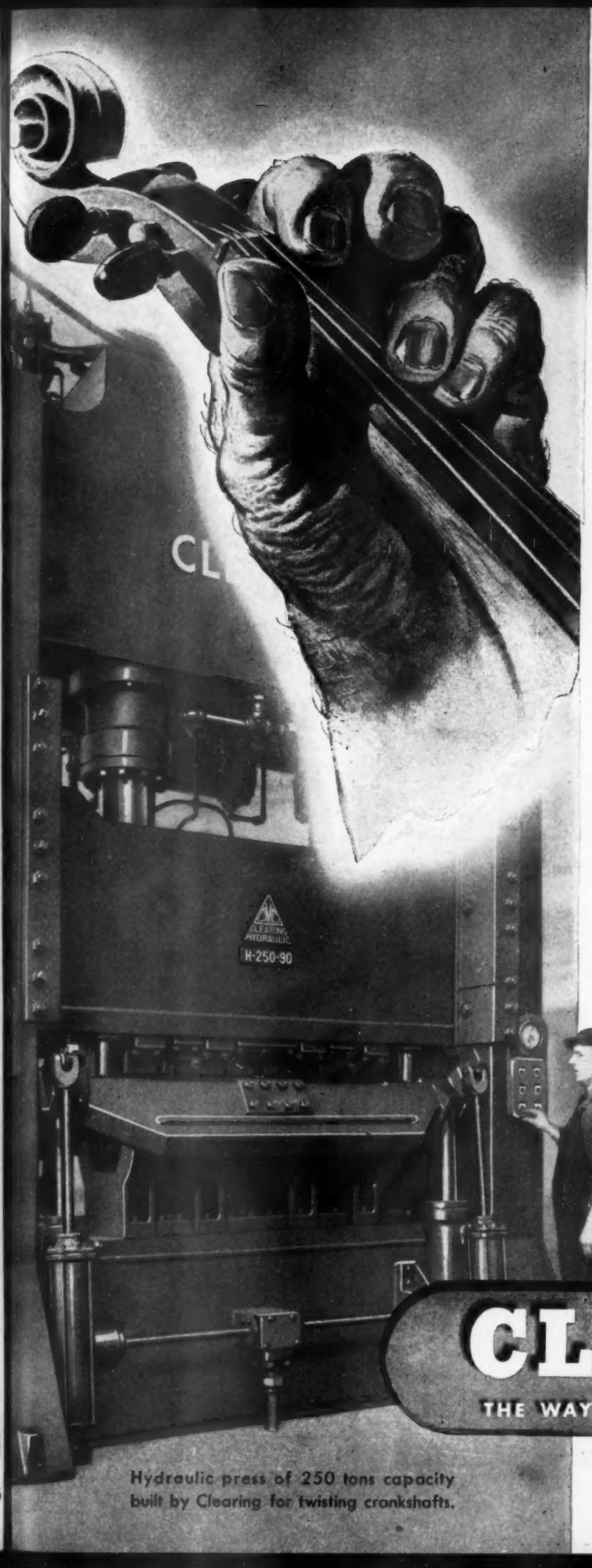


Hydraulic press of 250 tons capacity built by Clearing for twisting crankshafts.

OVERTURE to Low Cost Production

You scarcely expect harmonious results when the huge, muscular fingers of a blacksmith assault the strings of a violin—that's a task demanding delicacy and agility, not overwhelming strength. Yet the sweetest music a cost-minded executive can hear comes from the combination of precisely these qualities in a production machine.

Everyone knows that a *press* delivers parts faster and at lower cost than any other available means of production. Conventional thinking is likely to overlook this extremely valuable asset when the parts to be produced are quite large or call for maintenance of relatively close tolerances. Clearing, on the contrary, has deliberately designed and built presses to make production dreams come true—presses of gigantic size and exerting tremendous pressures, yet so constructed as to hold tolerances unbelievably close. Such a press may be the answer to your cost problem.

When you think of Clearing presses it is well to forget previous conceptions as to press limitations. Many a Clearing press is today producing, in a single stroke, a part which formerly required much more complex and costly procedures. If you are seeking new ways to meet a coming competitive situation, Clearing engineers may be able to help you. It costs you nothing to consult us, to find out exactly what one or more Clearing presses can do to bring down your cost figures.

CLEARING

THE WAY TO EFFICIENT MASS PRODUCTION

CLEARING MACHINE CORPORATION

6499 WEST 65TH STREET • CHICAGO 38, ILLINOIS

ANOTHER TOUGH JOB
"Vapor Degreased"

BUFFING COMPOUNDS

ALUMINUM

DRAINAGE

HIGH SPEEDS

There were many questions to consider when the new production line was planned at the Doehler Jarvis Corporation, Batavia, N. Y. Theirs is high speed production of aluminum kitchen-ware. The main question, "Could a standard cleaning process be used to do this job at speeds up to 29 feet per minute?"

Yes! A standard Detrex degreasing process, using PERM-A-CLOR solvent was selected by their engineers and is now being used to remove buffing compounds and to dry the work without spotting. There were, however, special features required within the equipment furnished:

1—Banks of sprays were installed, to remove the buffing-compound insolubles before they became "caked-on" by the vapor heat.

2—Accessible traps were provided to remove insolubles from the solvent without interrupting production flow.

3—Special filters were included in all pump lines—a further aid to operation and maintenance.

Thus, a tough cleaning job is accomplished with PERM-A-CLOR solvent and a standard process tailored for a specific application.

Yours may require only a standard unit of which there is a wide variety available. Whether it's a standard or a special application, a Detrex field representative in your locality is qualified to give an unbiased recommendation, should it be solvent degreasing, alkali, or emulsion. Call him in on your next requirement.

DETREX *Corporation*

DETROIT 32, MICHIGAN

E-142

The Lyon

INTERNAL GROOVING TOOL

Its versatility saves costly preparation time—provides precision grooving of single or multiple grooves at a production rate—plus economy of set-up time—and low initial cost. The LYON has been designed for making internal grooves to tolerances of .001" using any drill press, turret lathe, radial drill or automatic equipment.

By changing only bushings and cutters within the tool model range, you have at your command a wide variety of bore sizes and shapes. A simple adjustment regulates location and depth of groove. Work cannot be scratched or marred because the head of the tool does not turn when the cutter operates.

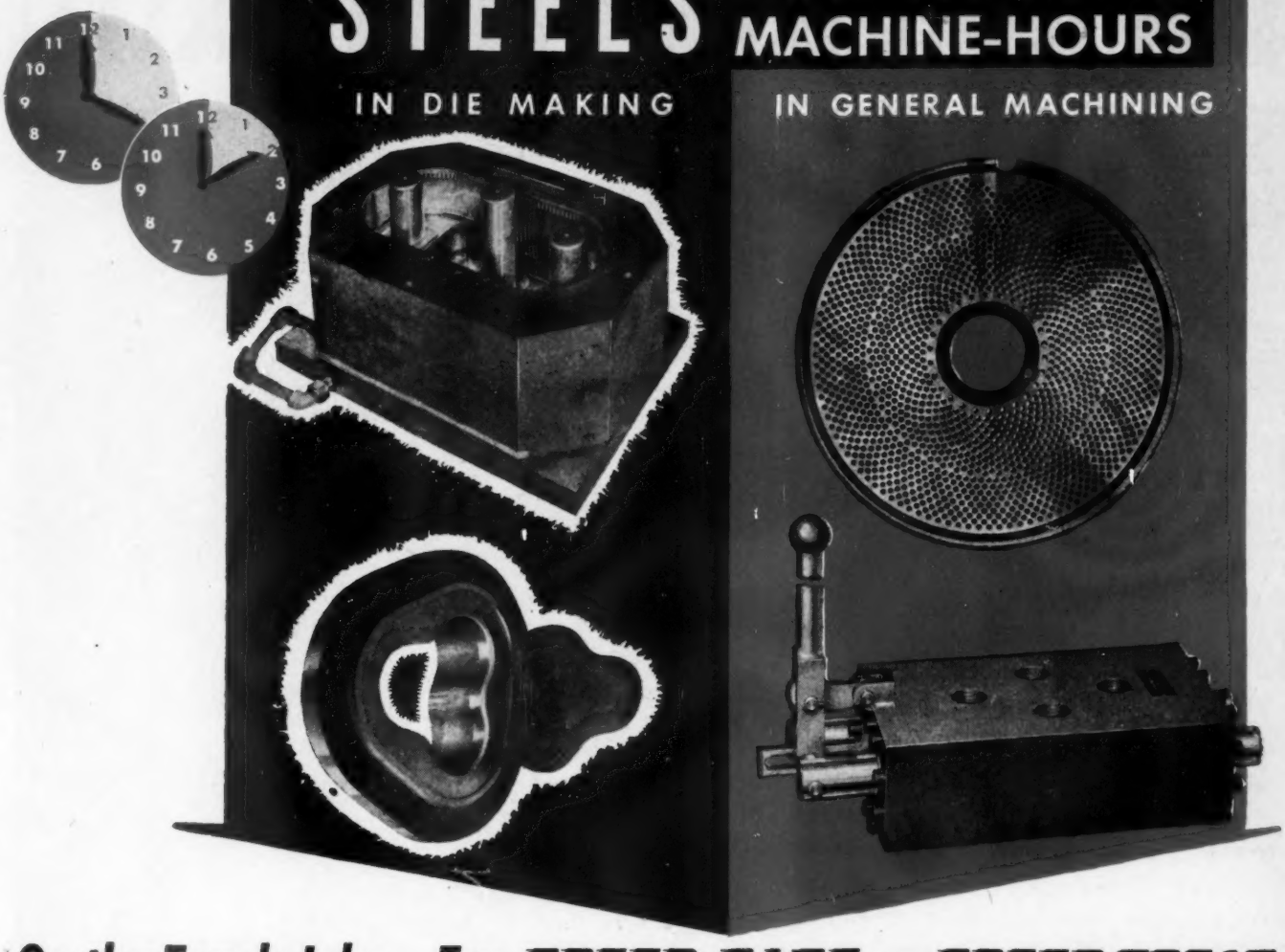
Our Engineering Department will welcome the opportunity of discussing any grooving problem without obligation.

LYON MACHINE CO.,
WORCESTER 3, MASS.

STEELS THAT CUT DOWN MACHINE-HOURS

IN DIE MAKING

IN GENERAL MACHINING



On the Tough Jobs...Try SPEED CASE or SPEED TREAT

Whenever you have a job requiring steel plate, where machine-time per part will be long and costly, use Holliday "time saver" low carbon *Speed Case* or medium carbon *Speed Treat*. Typical applications are found in all types of die making . . . and in general machine work on such parts as (above) food chopper plates and hydraulic valve blocks. Free machinability, exceptionally smooth finish, and minimum warpage in heat treating or carburizing are a few of the outstanding advantages offered by these unusual steels. Let us give you the facts . . . send your inquiry to the nearest warehouse listed below.

SPEED CASE
LOW CARBON
AND
SPEED TREAT
MEDIUM CARBON
OPEN HEARTH
FREE MACHINING
STEEL PLATES

W. J. HOLLIDAY & CO.

Speed Case—Speed Treat Plate Division

HAMMOND, INDIANA

Plants: Hammond and Indianapolis, Indiana

Distributed Coast-to-Coast in All Common Plate Sizes from these Warehouses:

AKRON 1, Ohio
The Burger Iron Company
BUFFALO 5, New York
Beals, McCarthy and Rogers, Inc.
BOSTON 10, Massachusetts
Brown-Wales Company
DETROIT 7, Michigan
Peninsular Steel Co.
HOUSTON 1, Texas
Earle M. Jorgensen Co.
LOS ANGELES 54, California
Earle M. Jorgensen Co.
MEMPHIS 2, Tennessee
Pidgeon-Thomas Iron Company
NEWARK 5, New Jersey
Grammer, Dempsey & Hudson, Inc.
OAKLAND 7, California
Earle M. Jorgensen Co.
PHILADELPHIA 34, Pennsylvania
Horace T. Potts Co.
CANADA: Toronto 2, Ontario, Peckover's, Ltd.

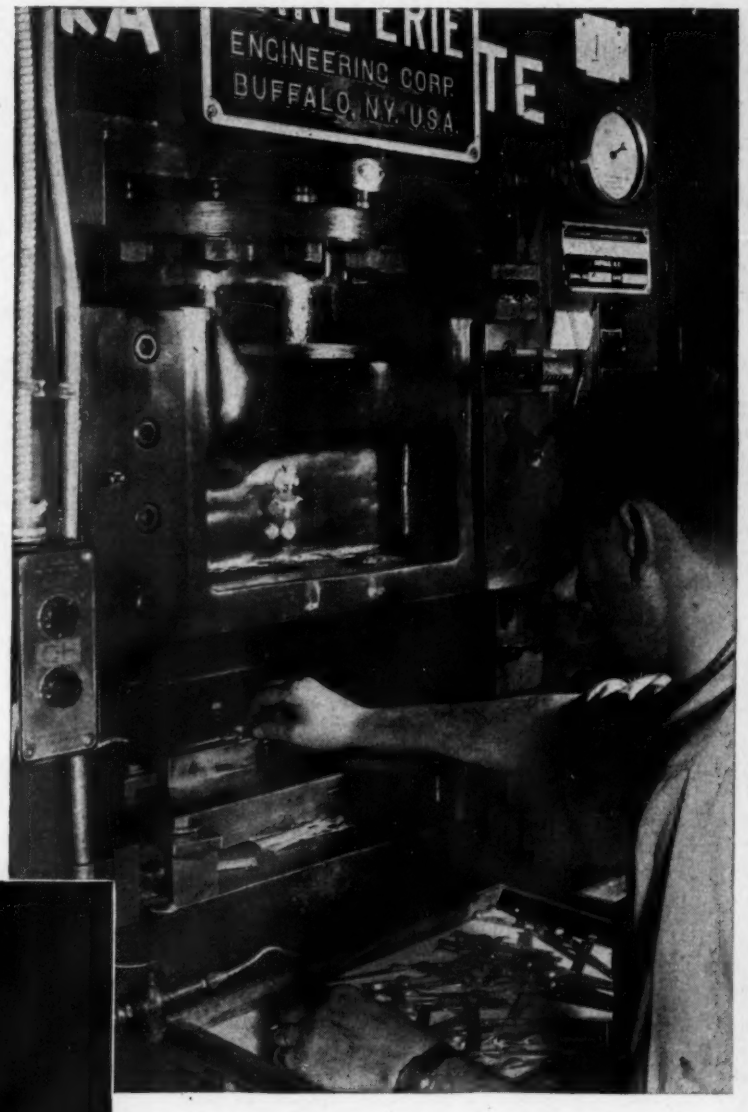
HICKOK uses LAKE ERIE

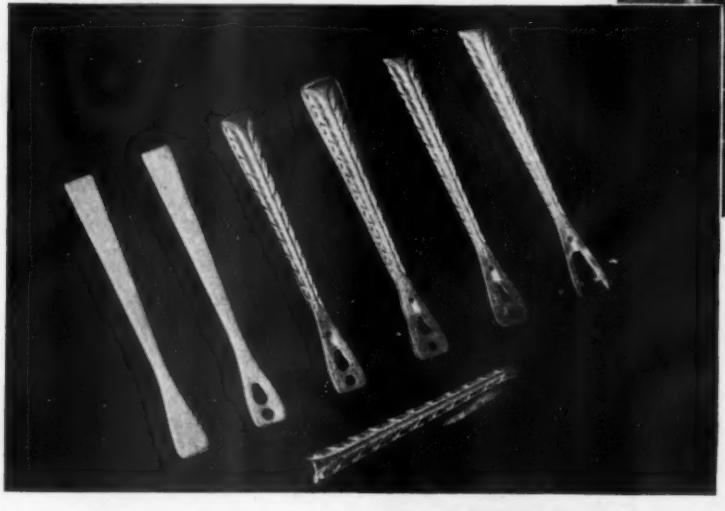
Lake Erie Hydraulic Presses in the Hickok plant in Rochester, N.Y. Press at left has 150-ton capacity, that at right 300-ton capacity. Presses are used in the manufacture of tie clasps, key holders, belt buckles and other items of men's jewelry.

HYDRAULIC PRESSES

to produce its nationally-known line of men's jewelry

Speed and precision are the two important requirements hydraulic presses must meet in manufacturing Hickok products. Speed is essential because of low unit cost. Precision is necessary due to the fineness of the work and the high standards of quality that must be met. The ability of Lake Erie Hydraulic Presses to meet these requirements is evidenced by Hickok's recent order for three more Lake Erie Hydraulic Presses to augment the two already in service. No matter what your requirements, Lake Erie can meet them with a hydraulic press that will do your job faster, better, more economically. Write today for latest hydraulic press literature or submit your specific press requirements to Lake Erie.





ABOVE—Close-up of Lake Erie Hydraulic Press stamping tie clasps. Lake Erie Presses are used for blanking, embossing and perforating operations.

LEFT—Steps in the manufacture of a tie clasp —blanking, embossing, trimming, perforating and final assembly at bottom.

Lake Erie Engineers, through their day-to-day contacts with leading manufacturers, have a wealth of information about methods for improving product quality and plant efficiency with hydraulic presses. This practical experience is available to you for the asking. Consult Lake Erie's Engineers.

LAKE ERIE
ENGINEERING CORP.
BUFFALO, N.Y. U.S.A.

LAKE ERIE
ENGINEERING CORPORATION
507 Woodward Ave., Buffalo 17, N.Y.

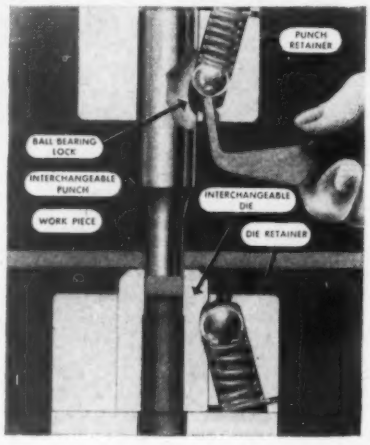
Offices in Principal Cities and Foreign Countries

Leading manufacturer of hydraulic presses —all sizes and types—metal working... plastic molding...processing...rubber vulcanizing...stereotyping...special purpose.

PUNCHES and DIES are *Quickly* INTERCHANGEABLE

Allied's R-B Interchangeable Punches and Dies are quickly installed for trouble-free production in the metal-working and plastics industries. They are available from stock in *standard* round, oblong and square shapes of almost any required size. Specials of any size, shape or material are promptly furnished to your specifications—and delivery dates are *dependable.*

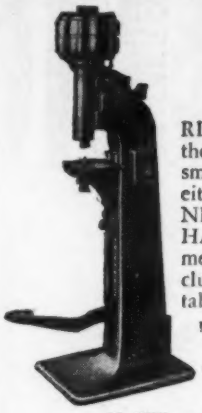
Write today for large illustrated R-B Catalog.



ALLIED PRODUCTS CORPORATION

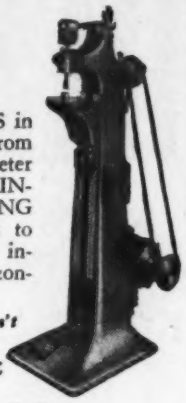
Department 20
4612 Lawton Ave. Detroit 8, Michigan

GRANT



RIVETERS — PIONEERS in their line—head rivets from smallest to 5/8" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.



THE GRANT MFG. & MACHINE CO.
85 Silliman Ave., Bridgeport, Conn., U. S. A.

REED-PRENTICE

LATHES
DIE CASTERS
DIE SINKERS
VERTICAL MILLERS
INJECTION MOLDERS

REED-PRENTICE CORP
WORCESTER MASS U.S.A.

BAUMBACH *The* DIE SET AUTHORITY

All Baumbach Die-Sets have demountable Leader Pins and Bushings. This exclusive feature permits removing Leader pins for machine work on the die shoe and assures reassembly without loss of alignment. A big time and trouble saver. Write for Catalog.

E. A. BAUMBACH MFG. CO., 1804 S. Kilbourn Ave., Chicago 23, Ill.

PRESSES
FEEDS
AUTOMATIC EQUIPMENT
THE V & O Press Co.
HUDSON N Y

For Man-Hour Savings— For Better, Smoother Work— USE A "HOLE-HOG"

• Boring—rough, semi-finish and finish • Honing • Milling (special machines) • Straight Line Drillers • Universal Adjustable Spindle Drillers • Way Type Machines—horizontal and vertical drilling, tapping and boring machines.

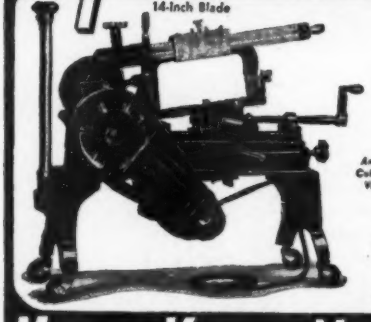
Since 1901, Moline machine tools have been producing better work, continuously, at greater production and man-hour savings. They are ruggedly built and engineered to fit your particular needs, but are easy to change over to other jobs.

Write us for information concerning machine tool equipment for your special problems.

MOLINE TOOL CO.
MOLINE, ILLINOIS

MOLINE TOOL COMPANY
105 20th Street Moline, Illinois

POWER HACK SAW ★



LOW PRICED
SELF-CONTAINED
PORTABLE
STURDY
READY TO WORK
ECONOMICAL

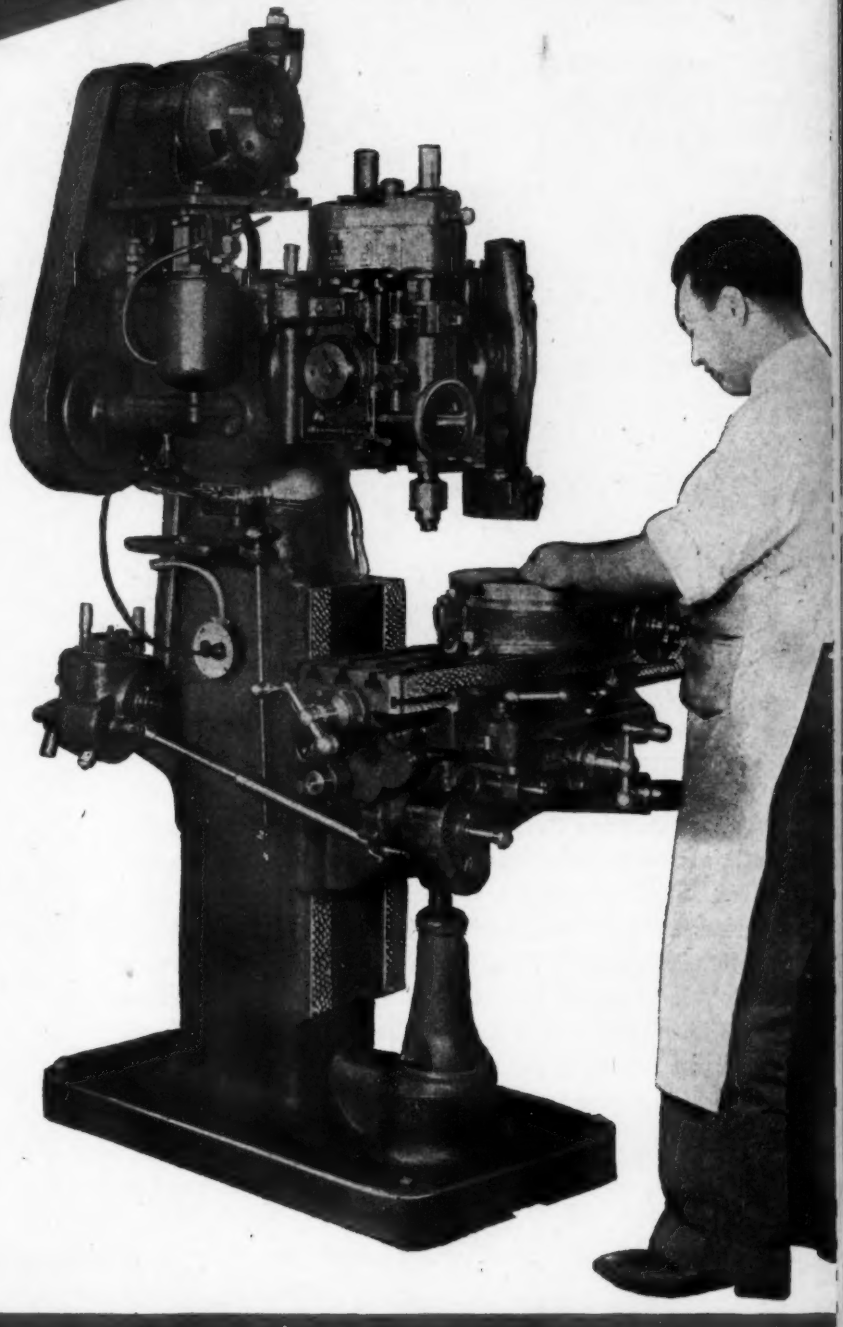
EXPORT DEPT.
1111 SO. FERRY BLD'G.
NEW YORK 4, N.Y.

WRITE FOR BULLETIN NO. 400

MILLER-KNUTH MFG. CO. OMAHA, NEB.

A MACHINE OF 1000 Production USES!

DoALL
RADIUS SHAPER and MILLING MACHINE



Amazing Range of Applications

This single machine does the combined work of several—makes jigs, dies, cams, forming tools, gages and many special parts. Just imagine the wide range of usefulness—drilling, boring, slotting, planing, milling, radius shaping, turning and filing! You can plane inside and outside rings; surfaces tangent to radii, or blend radii of different centers; plane horizontal, vertical or angular surfaces. You can mill square or angular surfaces, recesses, keyways, segments of holes and gear teeth, or turn outside segmental radii.

A Real Production Economy

Here are 4 reasons why you save time and increase production: 1—Many operations are performed at one chucking—saves time resetting work on various machines. 2—This machine does the combined work of others—makes investment in some unnecessary. 3—No need designing and making special tools and fixtures on other machines for special jobs that can be done with standard tools on this machine. 4—Layout work often eliminated by simply using the table graduations.

Send for illustrated circular giving full details and numerous applications.

DoALL Products Include

Contour Saws, Saw Bands, Band and Jig Filers, Files, Surface Grinders and equipment, Radius Slotting and Milling Machines, Lathes, Profilers, Automatic Inspection Machines, Gage Blocks and Inspection Instruments, Variable Speed Drives, Tool Steel.

The DoALL Company

Reg. U.S. Pat. Off.

DoALL STORES IN PRINCIPAL CITIES

SMALL TOOL DIVISION
DES PLAINES, ILLINOIS

FASTER FINISHING of HARDENED "V" and FLAT WAYS with the MATTISON GRINDER

The job being ground on the Mattison Grinder is a bed for the Sidney Lathe shown above.

● The Mattison Surface Grinder provides a practical and time-saving method for grinding to utmost accuracy, hardened "V" and flat way surfaces. One example is shown above, where a bed for the Sidney Lathe is ground to closest accuracy in 6 hours on a Mattison Grinder, which is a substantial saving in time over previous method. This is but one of the many jobs wich the Mattison Surface Grinder shown, handles to advantage for Sidney Machine Tool Company.

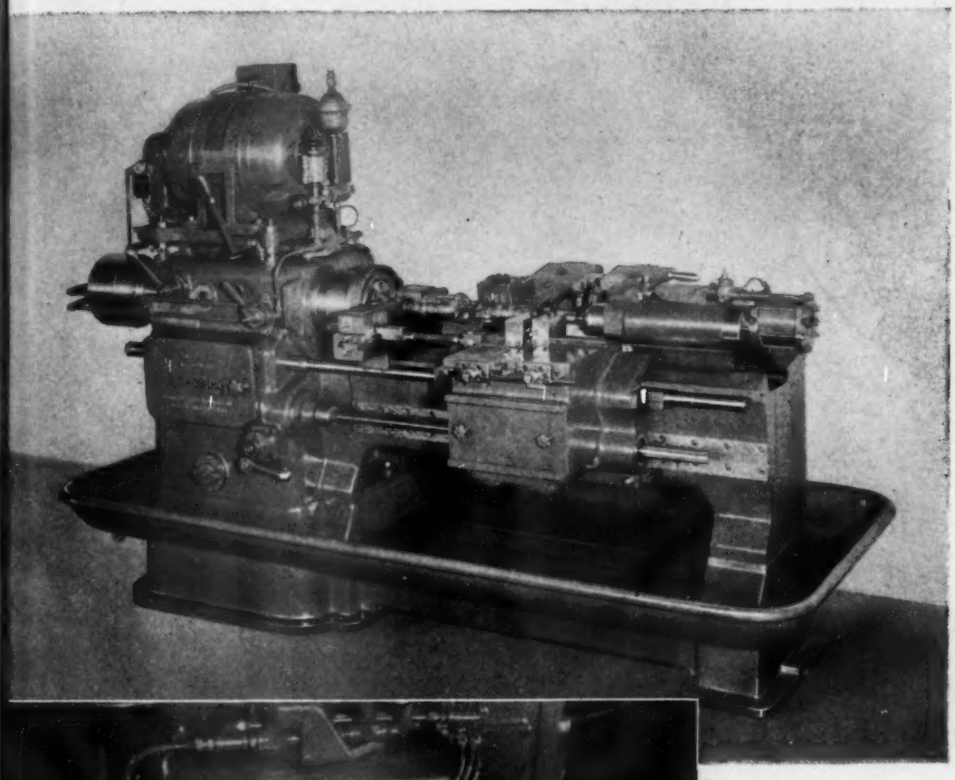
● The great vertical and horizontal capacity of the Mattison Grinder makes it possible to grind one large part or many small parts with equal speed and facility. On sizes 12″ to 36″ wide, 36″ to 192″ long, Mattison Grinders are rigidly built to do high-powered precision grinding, maintaining accuracy on an extremely wide range of work.

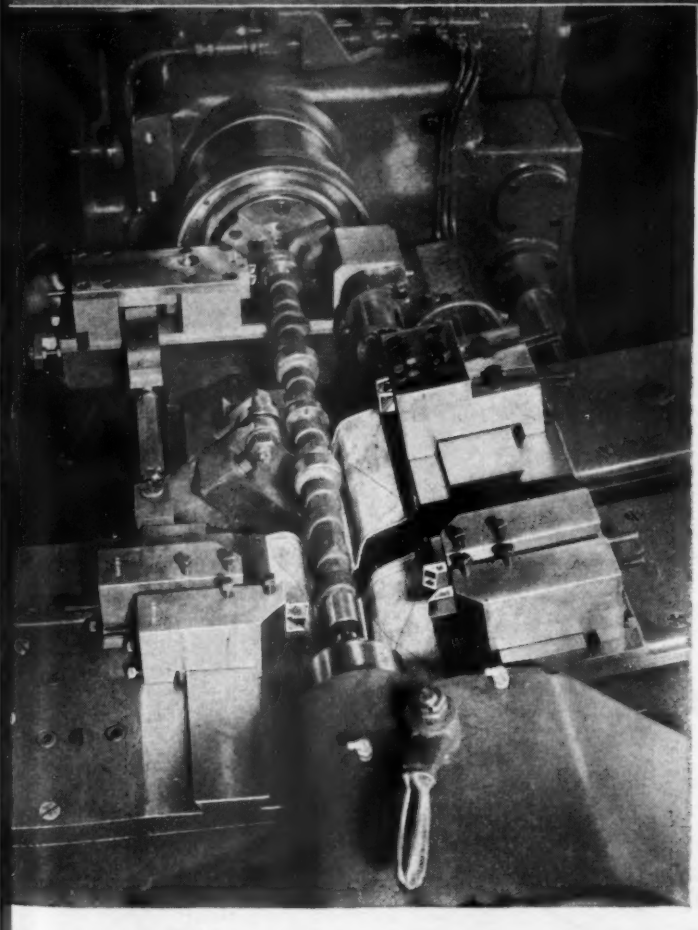
Write for free Set-Up Book, containing further examples, showing how others have reduced time and increased production with Mattison Grinders.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

MACHINE OF THE MONTH

EPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK





Lo-swing
AUTOMATIC LATH

incorporates unique feature
for cam-shaft job and

Reduces the Number
Operations Required

Problem: To perform the followi operations on a 6-cylinder cam-sha Cut double eccentric oil groove head bearing; rough and finish tu small bearing; chamfer small bea ing; face and chamfer oil pump dri gear.

Solution: A 5x34" model "LR" L swing Lathe was selected for this jo It was equipped with a standard slide carriage, 2 back squaring attachments, front steac rest, a double eccentric grooving attachment and an aut matic 2-speed headstock. This 2-speed headstock and i automatic control are one of the unique features of t tooling for this particular job. Since cemented carbi tools were used, high speeds were essential for finish tur ing and squaring operations, yet were impractical for t double eccentric grooving operation. The lathe aut matically shifts from high speed upon completion turning and squaring operations, and goes into low spee for the double eccentric grooving operation.

The cam roller on the double eccentric grooving attac ment is automatically withdrawn from the cam path du ing the high speed portion of the cycle.

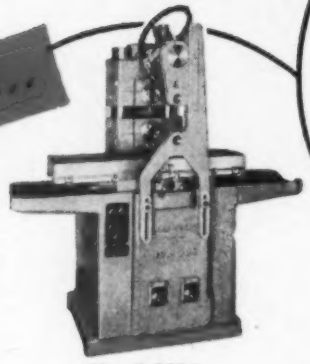
Another interesting feature of this lathe is the 2-slid carriage which accomplishes both roughing and finishin cuts on the small bearing. The roughing tool on th front slide relieves from the work before the tool on th second slide moves in for the finish cut.

Consult our Engineering Department for time-savin equipment.

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y

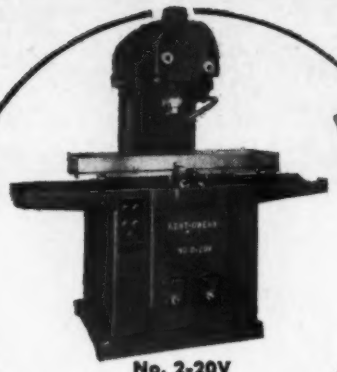
LATHE NEWS from SENECA FALLS

Rugged...



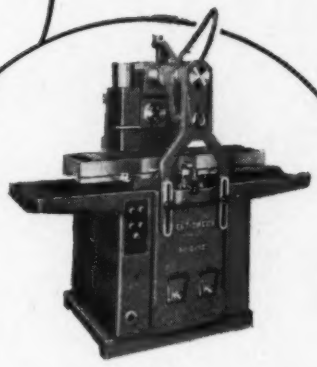
No. 2-20D5
Double Spindle for two milling operations at same time . . . 20" table travel . . . 42" x 12" table.

Efficient...

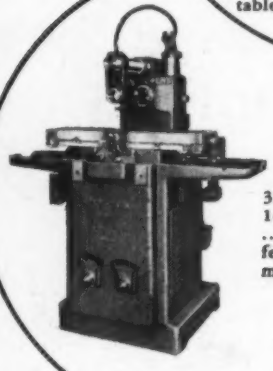


No. 2-20V
20" table travel . . . vertical spindle with speed range 32 to 1284 R.P.M. . . . 42" x 12" table.

Simple...



No. 2-20
20" table travel . . . 42" x 12" table . . . full automatic hydraulic table feed.



No. 1-14
32" x 9" table . . . 14" table travel . . . hydraulic table feed . . . full automatic cycle.

Standard
hydraulic and hand machines

KENT-OWENS

Milling Machines

Write for Bulletins. Kent-Owens Machine Co., Toledo, Ohio.

KENT-OWENS REPRESENTATIVES

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BUFFALO — Don W. Peterson
CHICAGO — Neff, Kohlbusch & Bissell
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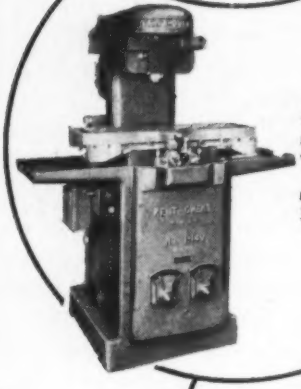
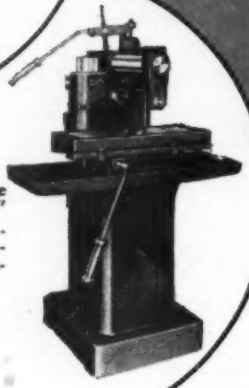
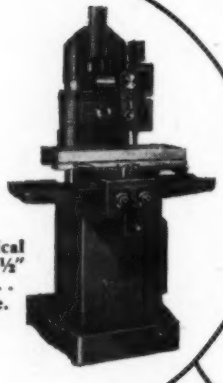


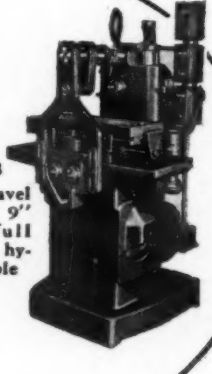
No. 1-14V
14" table travel with full automatic cycle . . . vertical spindle with speed range 115 to 3000 R.P.M.



No. 1-M
Hand feed to table and head . . . 25" x 9" table . . . 1 H.P. . . . head counterbalance is adjustable.



No. 1-V
Hydraulic vertical head feed . . . 5½" head travel . . . 25" x 9" table.



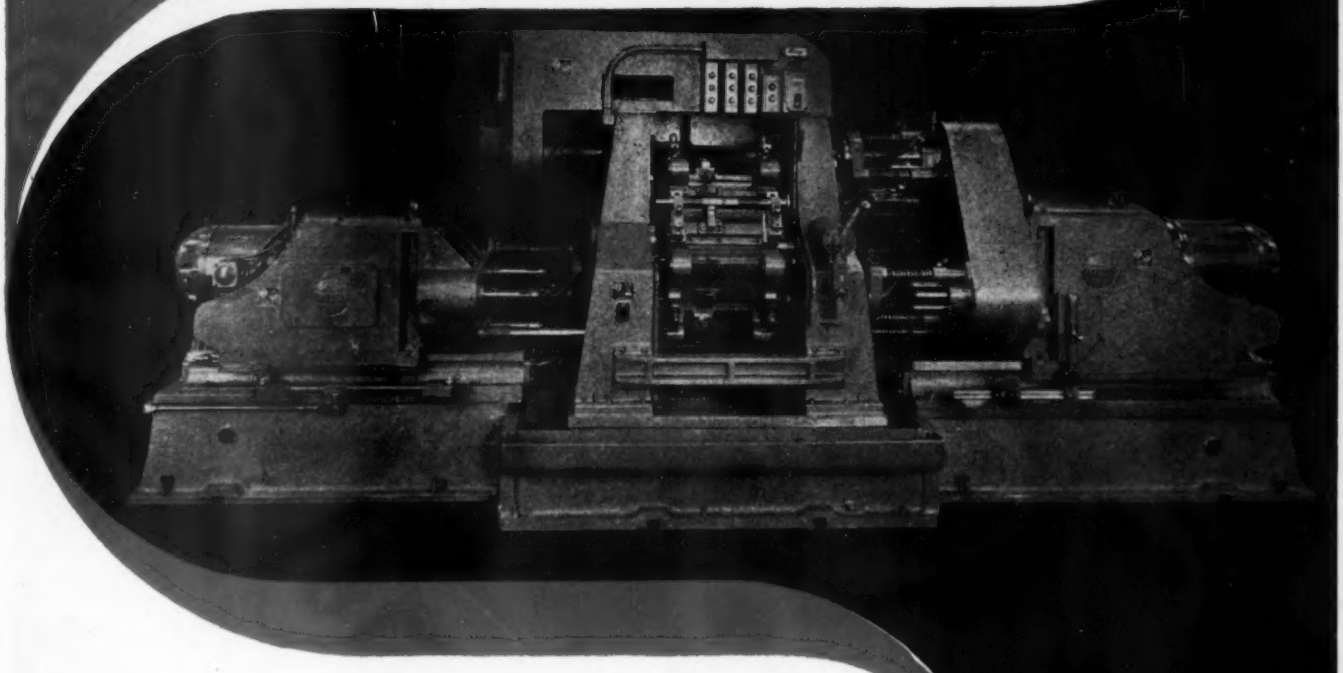
No. 1-8
8" table travel . . . 25" x 9" table . . . full automatic hydraulic table feed.

40 CRANKSHAFTS PER HOUR... is PROFITABLE production

Yes—when one machine unit can drill, ream, bore and chamfer the holes in one end of an automobile crankshaft and drill, chamfer and tap a hole in the opposite end of the shaft, completing 40 crankshafts per hour, it means PROFITS.

Designed to perform several production steps in one operation—machine tools such as this Baush 2-Way Horizontal Hydraulic Unit Type Multiple Spindle Drilling and Tapping Machine save time, labor and profits.

Baush production methods are profit-makers—a phone call, wire or letter will bring a qualified Baush Engineer to work with you on your problems.



Left Unit has Baush #20 hydraulic unit with 18" stroke and fixed center head furnished with 3 spindles driven by 5H.P. motor.

Right Unit has Baush #30 hydraulic unit with 18" stroke and fixed center head furnished with 14 spindles driven by 15 H.P. motor.

Both units are self-contained with hydraulic pumps and cylinders with adjustable feed rates and are provided with easily accessible pick-off gears for spindle-speed changes. Heads are of ball bearing design.

Six station trunnion type hand-indexed fixture holds 1 shaft at each station (1 loading station and 5 working stations). Left side of fixture has special individual leadscrew tapping unit furnished with single leadscrew tapping spindle powered by 2 H.P. disc brake motor.

Shafts are located from front and rear bearings and one connecting rod bearing in "V" block. Work is clamped by hand and guide bushings for finishing operations locate on outside of part.
Approx. net weight 18,000 lbs.

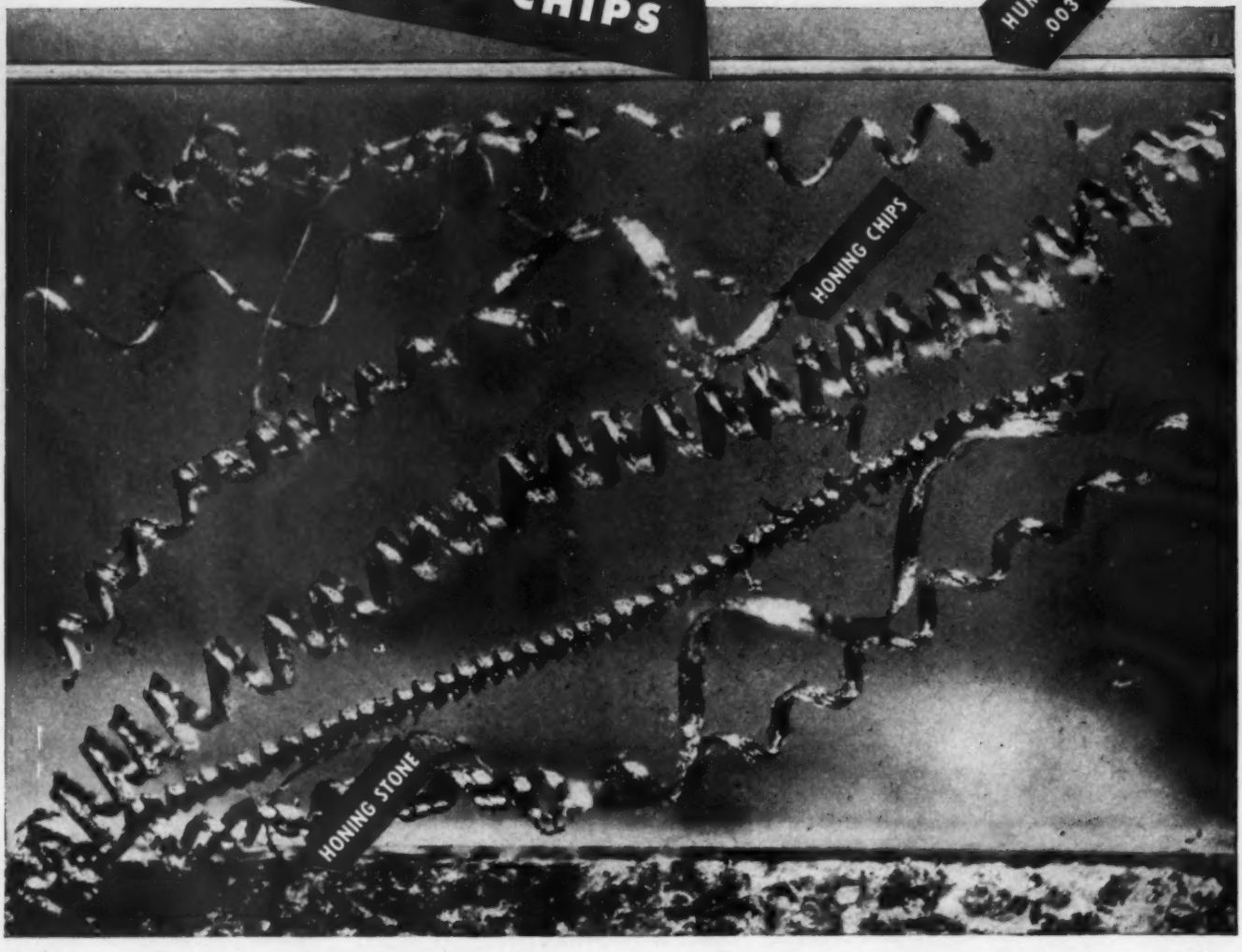
BAUSH
MACHINE TOOL CO.
SPRINGFIELD 7, MASSACHUSETTS

FOR

HEAVY STOCK REMOVAL

believe it or not—these are

MICROHONING CHIPS



Microhoning — today — can remove from 25 to 30 times as much metal as was ever before practicable: — up to .080 on diameter. Microhoning — today — can remove this much metal at rates from 6 to 8 times faster than has ever before been possible: — .006 to .008 per minute.

This important economic contribution to improved quality, lower cost high production, is produced by a combination of newly developed controls based upon the basic Micromatic application of thousands of simultaneous cutting contacts, actuated in low, impulse force shearing action under low speed, and extremely low pressure.

MICROHONING

Saves Time • Saves Operations
Increases Bore Quality • Increases Production

HONING MACHINES, HONING TOOLS, HONING FIXTURES AND HONING ABRASIVES

MICROMATIC

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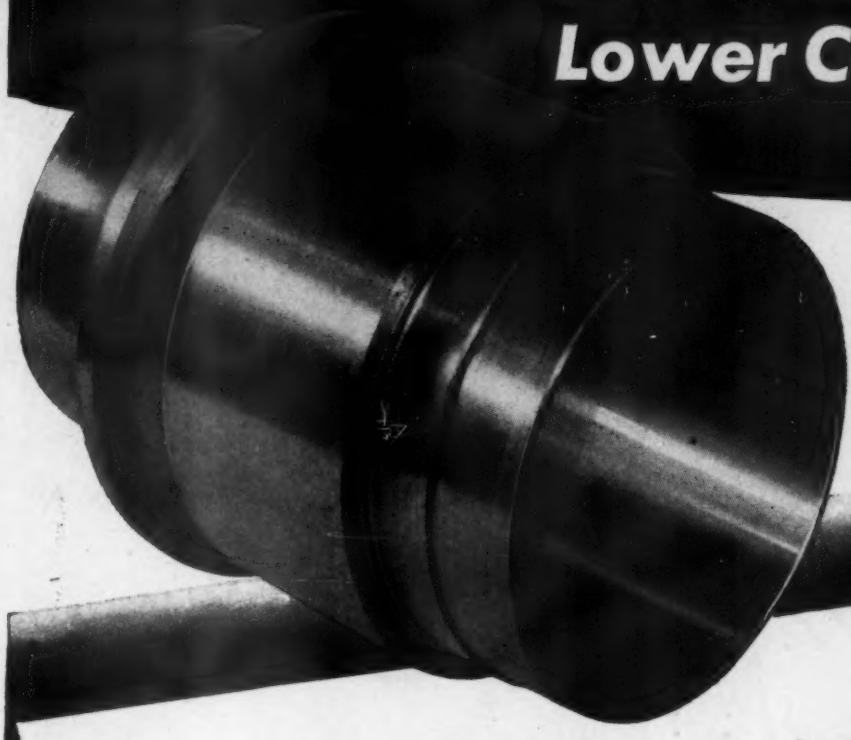
MICROHONING

is the Quicker, Better Lower Cost Method



MICRO MATIC

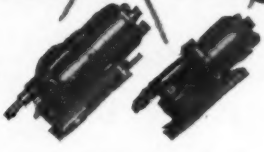
Here is the record of a typical case—an aircraft engine barrel.

Part — Aircraft Engine Barrel.
Size — 5.750″ diameter x 11½″ long.
Preceding Operation — Bored on Potter and Johnson or Bullard Machines.
1st Honing Operation Removes .025″ to .035″ in 1.75 min.
2nd Honing Operation Removes .007″ to .010″ in 1 min.
3rd Honing Operation Removes .004″ in 1 min.
Total Stock Removed .044″
Total Processing Time 3.75″ min.
No internal grinding needed.
Honing is the modern, economical method of final machining.

HONE CORPORATION DETROIT 4, MICHIGAN

Ohio, Phone: Hemlock 8261 • 927 A—M & M Bldg., P. O. Box 981, Houston 2, Texas, Phone: Preston 2381 • Room: 514—129 Church St., New Haven 10, Conn., Phone: New Haven 7-0035.

We put our heads together



. . . on every Fleximatic* to combine machining operations to best advantage. Such varied operations as drilling, reaming, tapping, hollow milling, spotfacing and counterboring are performed automatically while the operator removes a finished piece and inserts a new one.
Send us samples and prints of your jobs in this range. We will be glad to study them and show you what a Kingsbury Fleximatic can do . . .

to cut your drilling costs

KINGSBURY
MACHINE TOOL CORP.
KEENE, NEW HAMPSHIRE

Write for Bulletin F

* **KINGSBURY FLEXIMATIC**

—a special purpose machine for combined automatic operations during a single chucking —the result of Kingsbury engineering ability in the use of low cost *standard* Kingsbury drilling and tapping heads on *standard* Kingsbury bases.

New equipment gets the right start

for a long life—

START your new machines and equipment out right—have a Gulf Lubrication Engineer "in the picture" just as soon as it's delivered.

This trained specialist will check over your machines and equipment, then recommend the proper oils and greases which will provide an extra margin of lubrication efficiency.

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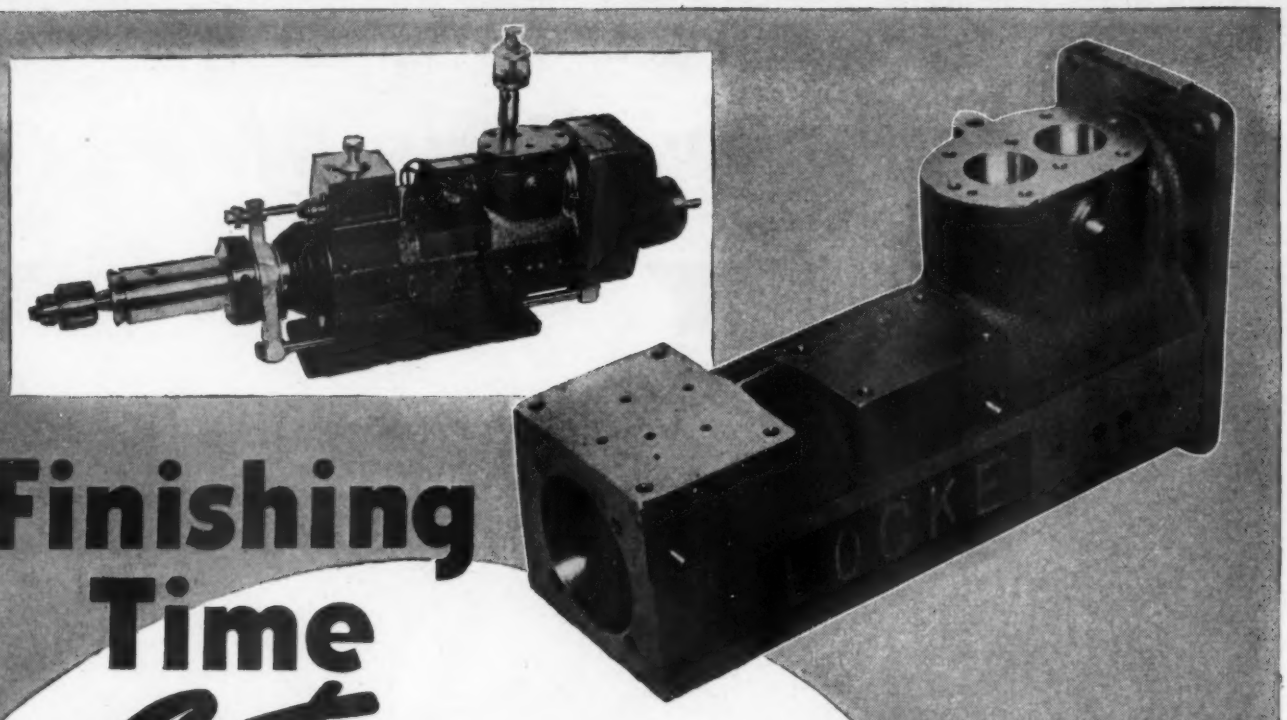
GULF INDUSTRIAL LUBRICATION

helps make machines
produce more at lower cost



Finishing Time *Cut* from 2 hours to 10 minutes

with Sunnen Precision Honing Machine

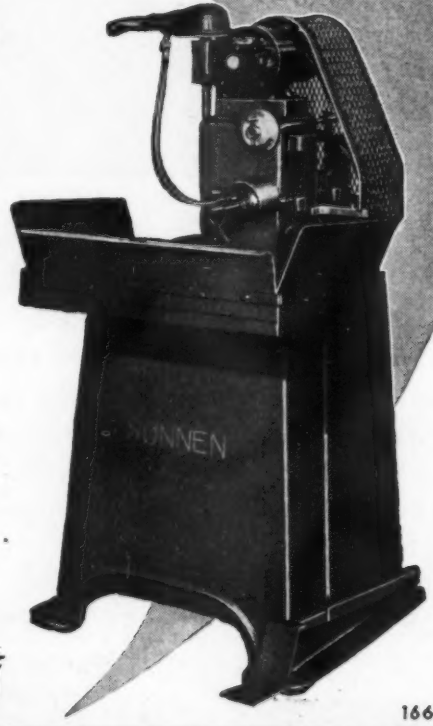
In addition to their tremendous saving in honing time, speed of assembly of parts was increased up to 300%; breakdowns were greatly reduced because parts now wear longer. So, finishing costs have naturally dropped to about 1/10th of the former cost (exclusive of material).

This part from a pneumatic drilling and tapping unit is made of cast iron — has one large blind hole 2⅛" in diameter and two open holes 1" in diameter. Tolerances are held to within .0005" and a 15 micro-inch finish is produced.

Here are *other* advantages you get from using this machine:

Handles wide range of sizes, from .125" to 2.625" • Produces accurate holes within .0001" • Can be set up, ready to operate in 1 minute Does not require skilled labor • Low in cost, economical to operate

Find out how these advantages can save time and money in your shop. Call in a Sunnen engineer, or write for complete details. If you have parts on which you would like recommendations, send them to the Sunnen Honing Laboratory.



SUNNEN PRODUCTS COMPANY

7941 Manchester Ave., St. Louis 17, Missouri

Canadian Factory: Chatham, Ontario

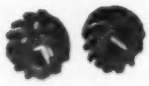
SUNNEN

166

Typical Jobs

Cast Iron Valve Stem Guide. ½ to one thousandth removed — 220 pieces per hour. Better finish and straighter hole.

Diesel Engine Fuel Injector Cylinder "So accurate that a piston can be fit within .00005 inch.



Automobile Distributor Shaft Gears. Taper removed at a rate of 80-90 per hour.

Roller Bearing Outer Race. Finish improved from 12 micro inches to 2 micro inches.

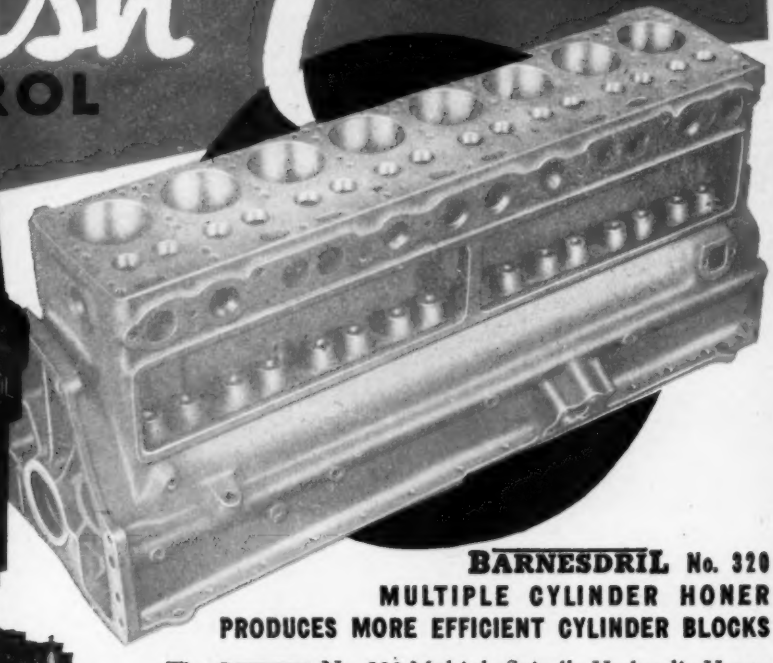
Compressor Yoke. Alignment maintained and better finish produced.

Bronze Valve. The Sunnen method of honing is used to secure a high finish and accuracy.

Hydraulic Two-Way Control Valve. Hole is honed to eliminate leakage.

GREATER Accuracy WITHIN .0005 + Finish CONTROL

Improved Products
Increased Production
Reduced Costs



BARNESDRIL No. 320 Multiple Cylinder Honing Machine, with 8-spindle auxiliary head. Fixture has hydraulic control for inserting and positioning cylinder block; also for removing block after honing. BARNESDRIL No. 4 Magnetic Automatic Coolant Separator shown, removes metal and abrasive particles from the coolant, thereby assuring a finer finish in less time. For complete details on this efficient, trouble-free, fully automatic unit, send for Bulletin No. A-151.

BARNESDRIL No. 320 MULTIPLE CYLINDER HONER PRODUCES MORE EFFICIENT CYLINDER BLOCKS

The BARNESDRIL No. 320 Multiple Spindle Hydraulic Honer is designed for high production cylinder bore honing of automotive engine blocks. Improved designs have made possible faster and more accurate stock removal.

The honing process eliminates high spots in the bore, generates size and accuracy for roundness and straightness, and produces any desired degree of surface smoothness. Final dimensional size accuracy within .0005" in hardest materials is easily and consistently obtained.

HONING CAN BE PROFITABLY ADAPTED TO YOUR WORK

Whatever your product . . . where extreme accuracy and controlled finish of internal and external surfaces are essential . . . there is a BARNESDRIL Honing Machine, with one or more spindles to accomplish *finer finish, greater accuracy, improve your product, with production increased and costs reduced.*

BARNESDRIL Honing Machines are available in vertical, horizontal or angular types; and will handle work up to and more than 40" diameter and lengths up to 75 feet or longer.

Send blueprints of your "part" for analysis and suggestions by BARNESDRIL engineers who will recommend the proper honing machine for your work.

No obligation, of course.

Additional Data

For more complete details and specifications of the BARNESDRIL No. 320 Honing Machine, write for free copy of Bulletin A-121.

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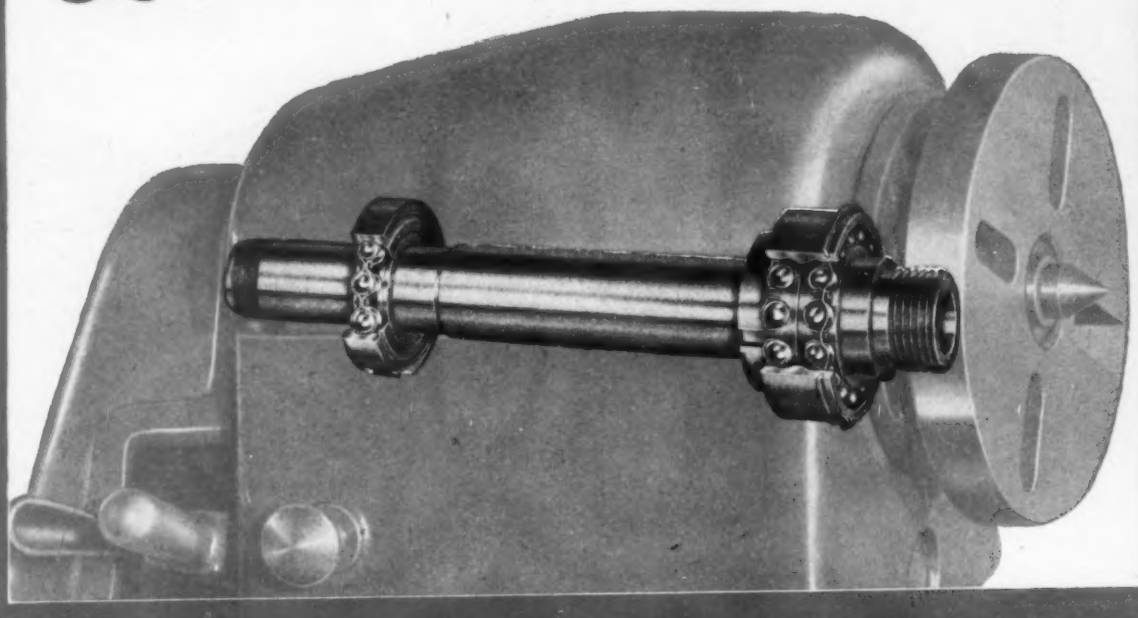
Barnes Drill Co. ROCKFORD ILLINOIS, U. S. A.

Logan — A NAME TO REMEMBER WHEN YOU THINK OF BETTER LATHES



BALL BEARING SPINDLE MOUNTING

permits higher cutting speeds, requires no bearing adjustment... sustains accuracy of LOGAN Lathes

Quick Change Gear Cabinet Turret Lathe

SPECIFICATIONS COMMON TO ALL LOGAN LATHES . . . swing over bed, 10½" . . . bed length, 43⅛" . . . size of hole through spindle, 25/32" . . . spindle nose diameter and threads per inch, 1½"—8 . . . 12 spindle speeds, 30 to 1450 rpm . . . motor, ½ hp, 1750 rpm . . . ball bearing spindle mounting . . . drum type reversing motor switch and cord . . . precision-ground ways, 2 V-ways and 2 flat ways.

With its spindle turning on a pre-loaded ball bearing mounting of extreme precision, the Logan Lathe is inherently well adapted to accurate work at higher spindle speeds. This fact permits the Logan Lathe operator to use modern high speed carbide cutting tools to full advantage. It assures a minimum of spindle deflection due to pressure of the cutting tool. It means, too, that no bearing adjustment is required within the full range of the Logan spindle speeds, 30 to 1450 rpm. Consequently, the accurate factory alignment of the Logan spindle is not disturbed by periodic bearing adjustments, and original accuracy is sustained. Grease sealed, the Logan Ball Bearing Spindle never needs lubrication. All these characteristics of the Logan Ball Bearing Spindle Mounting are important factors in the proved ability of Logan Lathes to increase output and decrease costs on production lines, and to do faster, more accurate cutting jobs in the tool room. For full information, see your nearest Logan Lathe dealer, or write direct for the Logan Lathe catalog.

M-1

LOGAN ENGINEERING CO. CHICAGO 30, ILLINOIS

POPULAR!

because it's..

portable
practical
profitable

SPECIFICATIONS

CAPACITY:
Rectangular . . 8" x 16"
(Special Guides) 5" x 24"

ROUNDS: . 8" diameter

MOTOR:
½ H. P., A. C. or D. C.

SPEEDS: Selective 60, 90, 130 feet per minute

WEIGHT:
Approximately 665 lbs.

USERS like Wells Metal Cutting Band Saws for a number of very good reasons. In the first place these saws, though rugged in design and construction, are compact, self-contained, and readily portable. You can move them to a point most convenient to the work. They take up little floor space. Wells saws are also 100% practical—simple to operate, yet capable of handling a wide variety of work without special fixtures. A third important reason for widespread popularity, is that thousands of users have found them highly profitable. For a small investment, you get a versatile tool that can help you in many ways...in breaking bottlenecks...in getting work out in less time. See your local Wells distributor, or write for details.

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METAL CUTTING BAND SAWS

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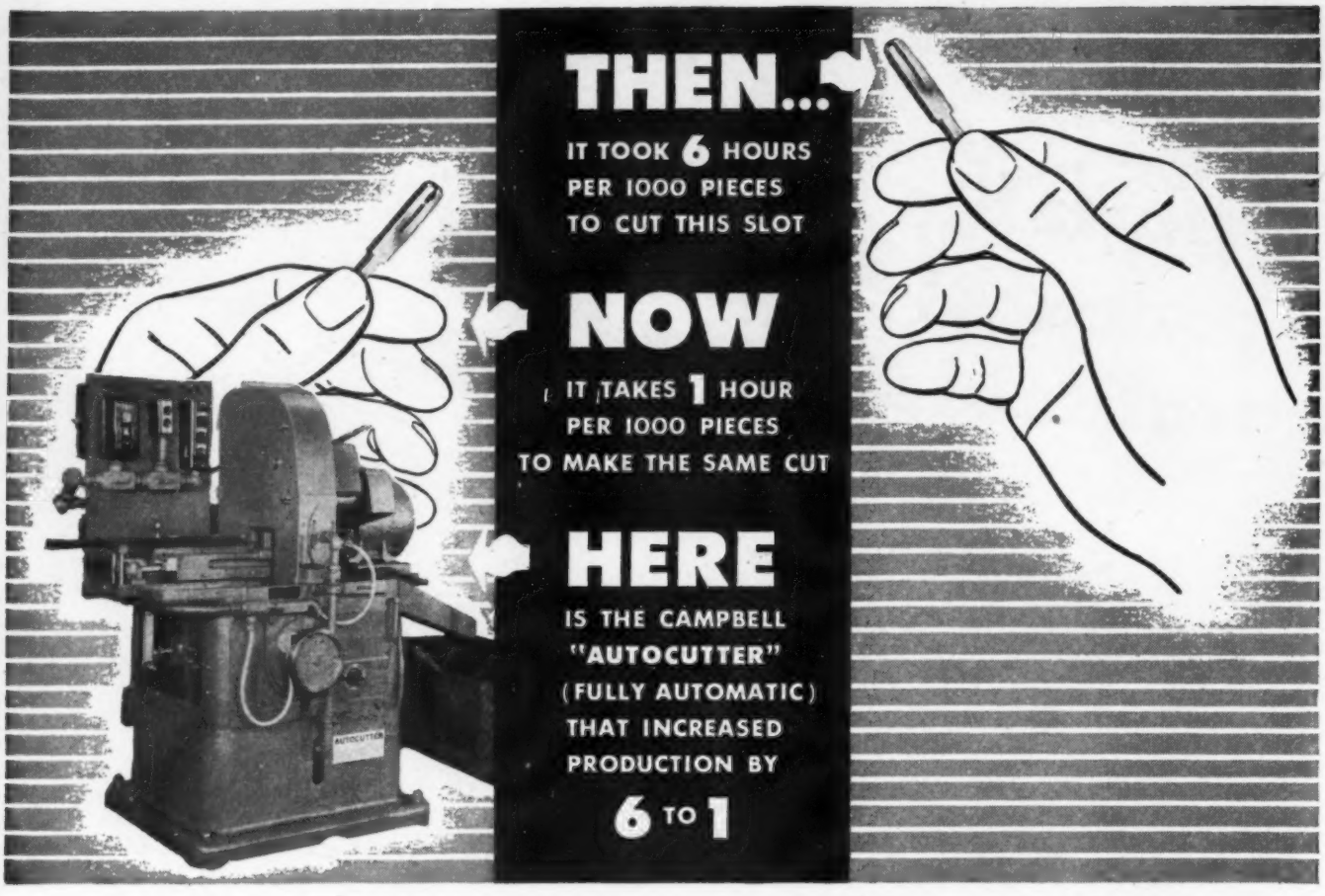
CAMPBELL ABRASIVE CUTTING MACHINES ARE PRODUCTION MACHINES


THEN...
IT TOOK 6 HOURS PER 1000 PIECES TO CUT THIS SLOT
NOW
IT TAKES 1 HOUR PER 1000 PIECES TO MAKE THE SAME CUT
HERE
IS THE CAMPBELL "AUTOCUTTER" (FULLY AUTOMATIC) THAT INCREASED PRODUCTION BY
6 TO 1

CAMPBELL MAKES A FULL LINE OF ABRASIVE CUTTERS

Send for your copy of this file-size catalog folder. Ask for DH-1315.

Campbell machines have been developed far beyond the simple function of cutting off materials. The job shown above, for example, is but one of many in which abrasive cutting is supplanting other conventional machining methods—speeding up and economizing production. Write for detailed information.

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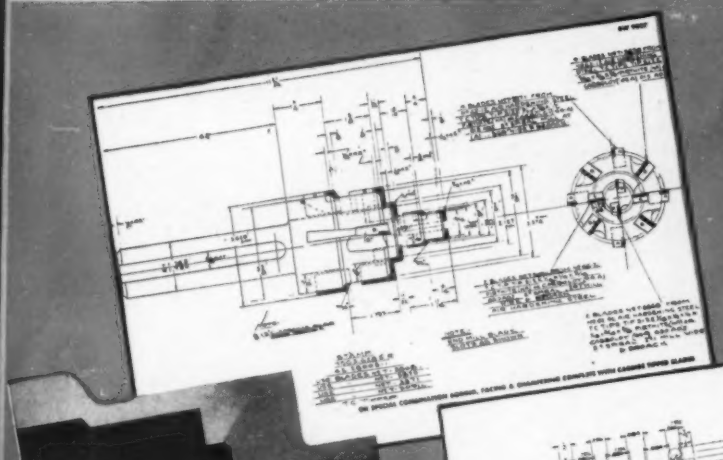
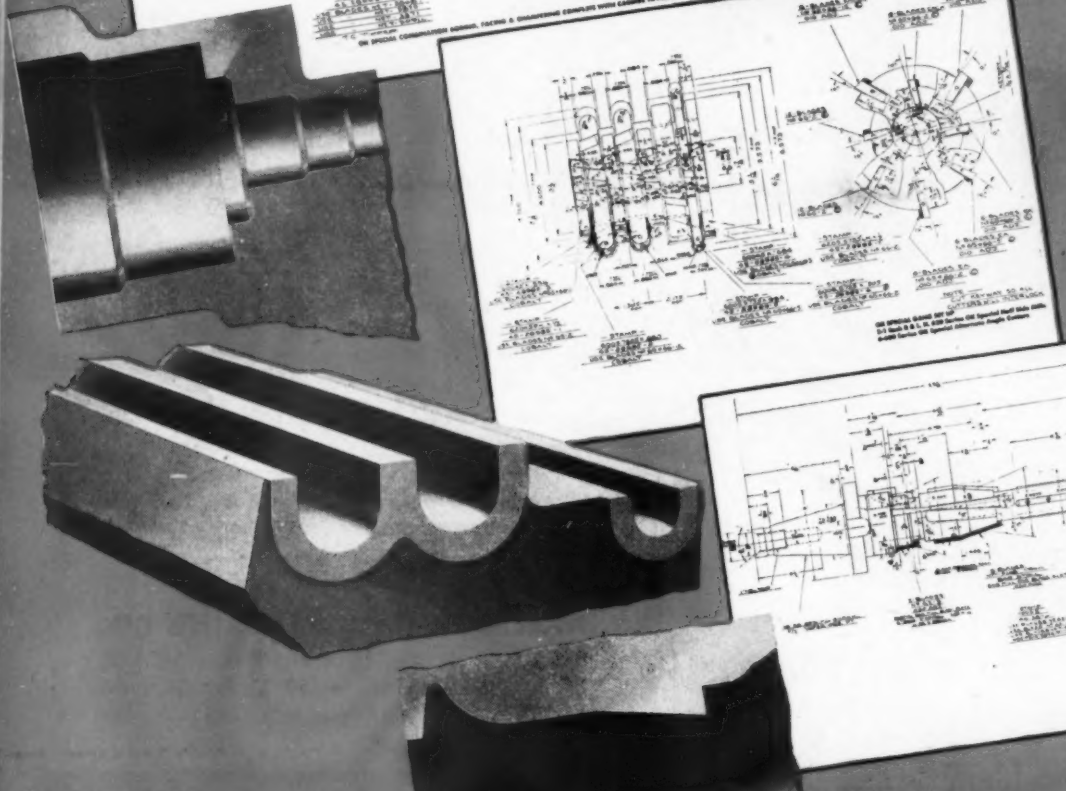
OK SPECIAL MILLING

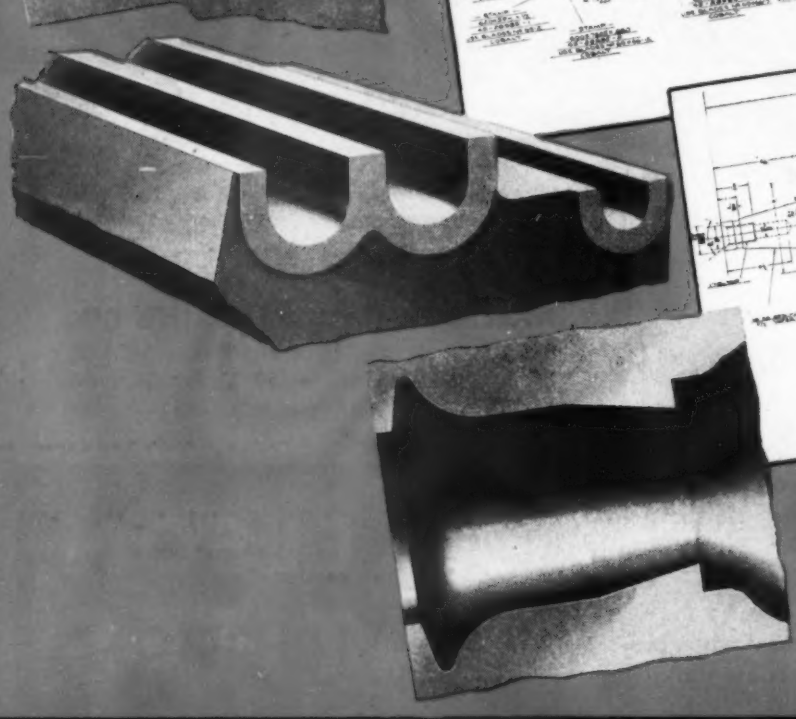
Special Gang Cutters for Combination Milling, Boring,



O K Special Combination Boring, Facing and Chamfering head with tungsten carbide tipped blades. Cored gray iron casting for a fuel pump housing. Simplicity of O K locking device lends itself to multiple blade combination tools.



O K Special Gang Form Mills combining alternate angle cutters with half side mills for machining round ways and top surfaces of a cast iron roll stand.



O K Special Piloted Combination Boring Head for taper boring, straight boring and spot facing — operations that require great rigidity for machining steel part.

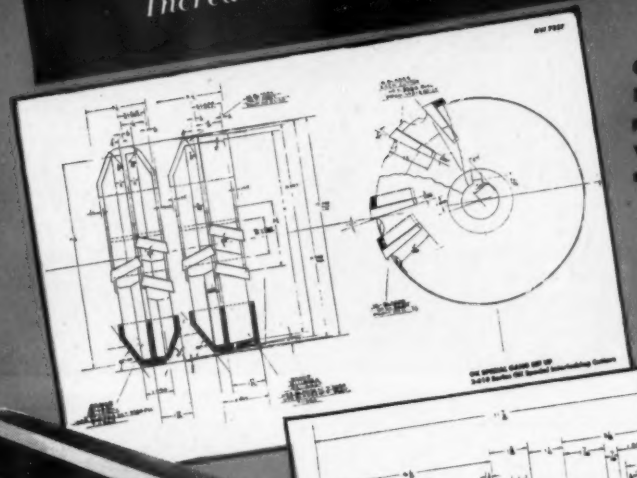
THE O K TOOL COMPANY, SHELTON, CONN.

America's No. One INSERTED BLADE METAL

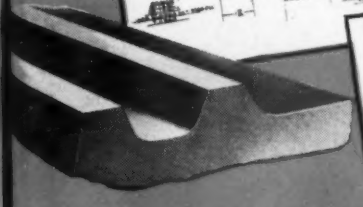
50 examples of... and BORING JOBS

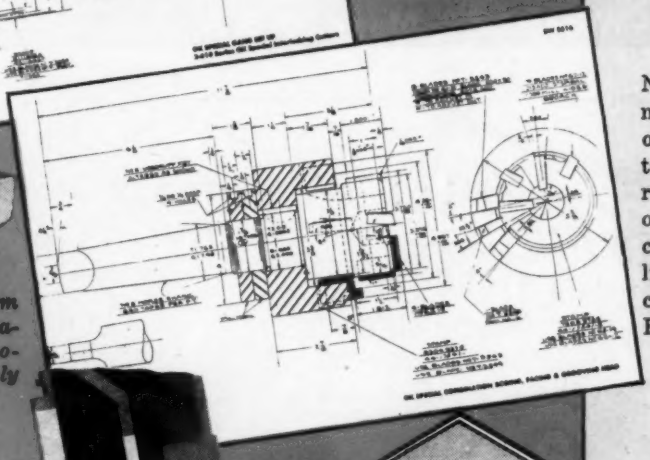
Facing and Chamfering

Complicated contours cut with one pass of special OK tools...
REMOVE MORE METAL PER MAN...PER MINUTE
Increased production—Inserted blades easily adjusted for wear

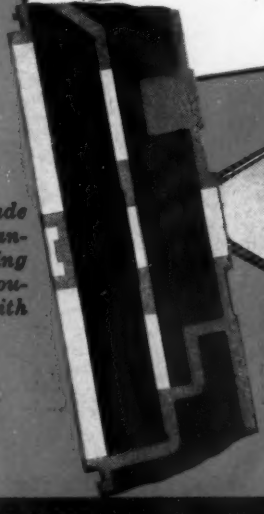


OK Blades are solidly locked in position without wedges, pins or shims.





O K Special Gang Form Milling Cutters for machining aircraft component part of chrome moly steel



O K Special Multiple Blade Boring, Facing and Trepanning Head for machining cored gray iron casting. Double operation performed with one combination tool.

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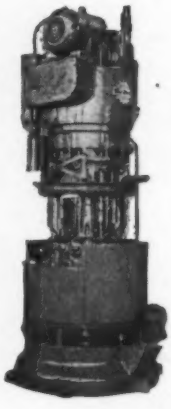
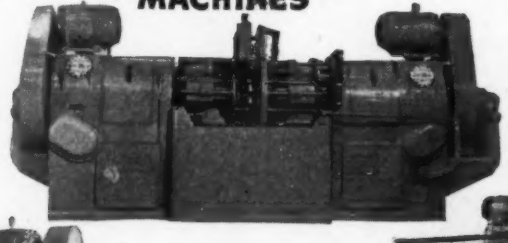
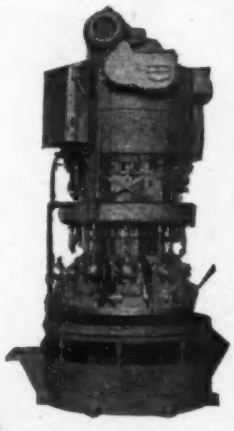
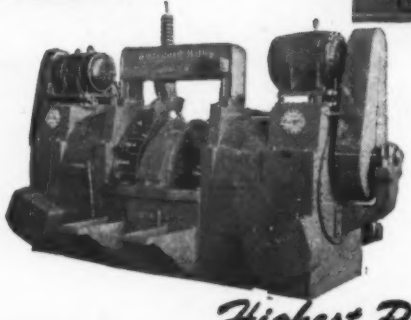


Roto-Matic Drilling MACHINES

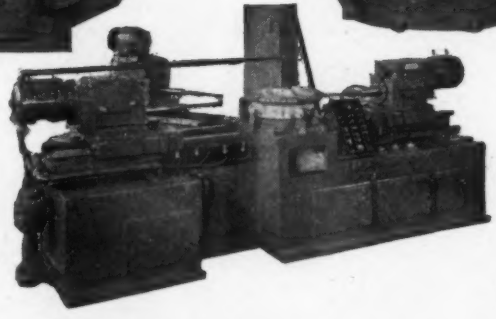
VERTICAL AND HORIZONTAL TYPES







MULTIPLE SPINDLES



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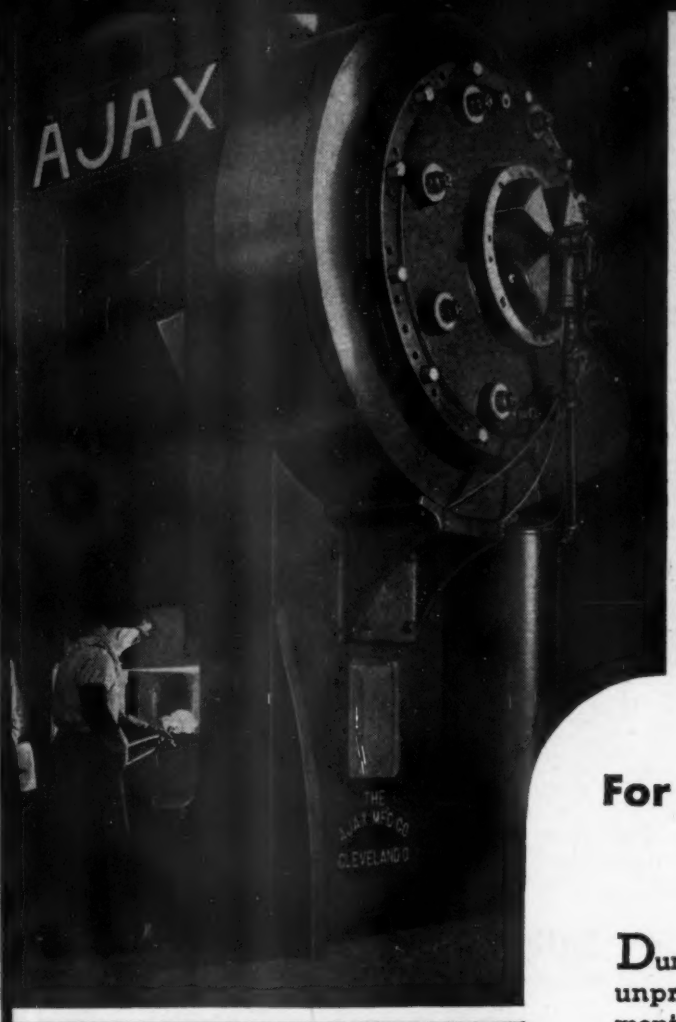

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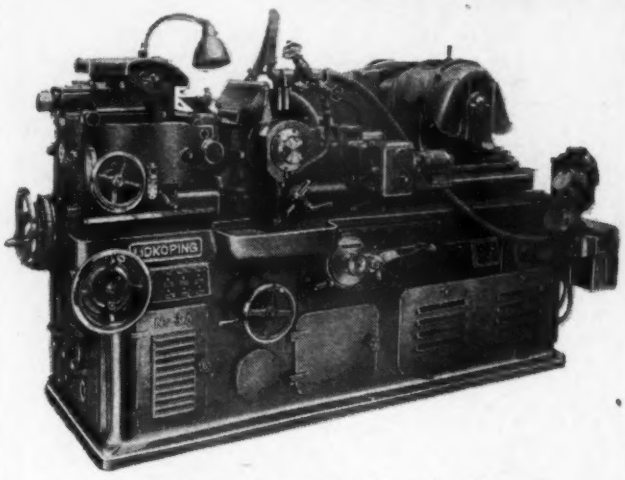

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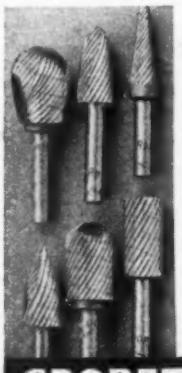

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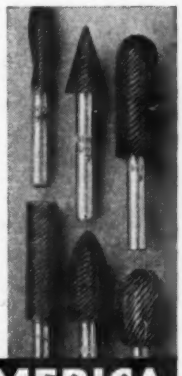
Hand Cut • Milled Cut Ground from the Solid

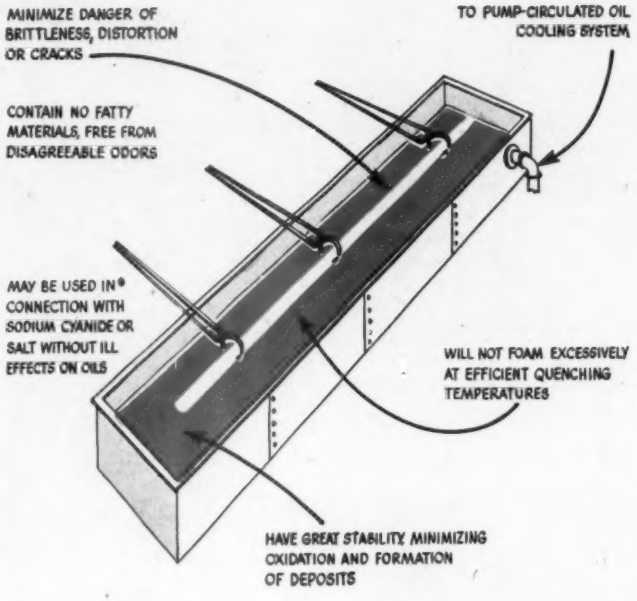
There is a GROBET ROTARY FILE in shape, size and coarseness of cut for every type of hard or soft metal, plastic, wood, etc. GROBET FILES do their jobs better and stay sharp longer.

Send for catalog DR, the most complete of its kind illustrating and describing GROBET Rotary Files, Diesinkers, Burs, Tube Burring Cutters, Chatterless, Countersink, etc.



GROBET FILE CO. of AMERICA
421 Canal Street 1812 F. L. GROBET New York, 13 N. Y.
IMPORTERS OF GROBET SWISS FILES MFRS. OF GROBET ROTARY FILES

STANDARD ENGINEERS NOTEBOOK


MINIMIZE DANGER OF BRITTLENESS, DISTORTION OR CRACKS
TO PUMP-CIRCULATED OIL COOLING SYSTEM
CONTAIN NO FATTY MATERIALS, FREE FROM DISAGREEABLE ODORS
MAY BE USED IN CONNECTION WITH SODIUM CYANIDE OR SALT WITHOUT ILL EFFECTS ON OILS
WILL NOT FOAM EXCESSIVELY AT EFFICIENT QUENCHING TEMPERATURES
HAVE GREAT STABILITY MINIMIZING OXIDATION AND FORMATION OF DEPOSITS

Stable oils produce uniform hardness in steel

Because they retain their original viscosities in continued use, Calol Quenching Oils maintain a constant quenching speed and produce uniform hardness in steels. They have a high resistance to oxidation, contain no fatty oils to produce disagreeable vapors.

Calol Alloy Quenching Oil consistently and quickly produces higher hardness in alloy steels. Its unusual cooling power is based on what is believed a new principle. Unlike water, it eliminates the chance of brittleness, distortion or cracks.

Calol Quenching Oil is recommended for high-carbon steels. Made from selected mineral oils covering a wide boiling range, it provides the moderate cooling-rate desirable for these steels.

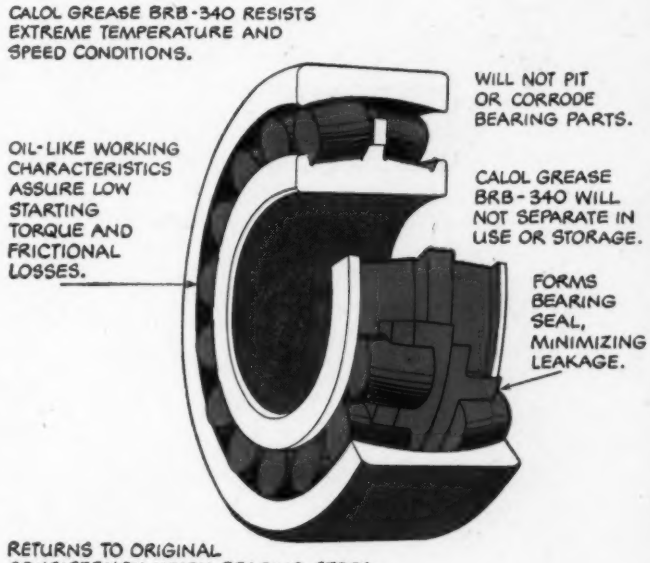
For suggestions on the use of Calol Quenching Oils, information about machining various metals and the lubricants required, write for the free booklet: "Calol Cutting Fluids."

Special BRB grease reduces running friction

Many operators obtain less starting drag and reduce running friction to a minimum in industrial ball, and roller bearings by lubricating them with Calol Grease BRB-340.

It is especially efficient in anti-friction bearings which must operate under severe conditions of speed and temperature. It contains an unusual amount of oil stock and at high shear rates, its apparent viscosity approaches that of the oil component. However, this does not promote undue leakage from bearings because Calol Grease BRB-340 has a peculiar ability of resetting, which causes the excess grease, swept aside by balls and rollers, to form a seal.

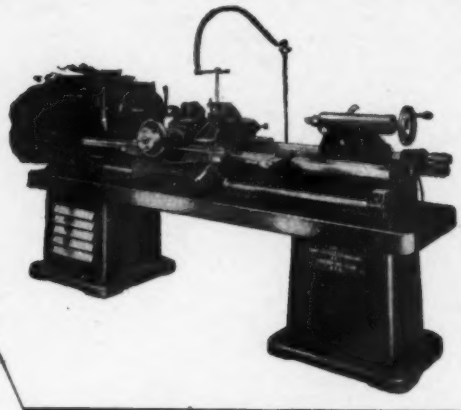
A special milling process in its manufacture eliminates bleeding. In severe tests, Calol Grease BRB-340 showed no separation in a bearing turning 10,000 rpm at 200° F. for several hundred hours. At the end of the tests both the bearing and the grease were in good condition.

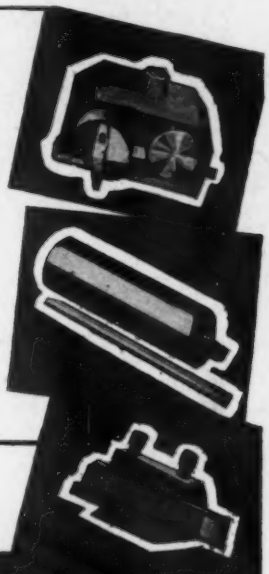

CALOL GREASE BRB-340 RESISTS EXTREME TEMPERATURE AND SPEED CONDITIONS.
WILL NOT PIT OR CORRODE BEARING PARTS.
OIL-LIKE WORKING CHARACTERISTICS ASSURE LOW STARTING TORQUE AND FRICTIONAL LOSSES.
CALOL GREASE BRB-340 WILL NOT SEPARATE IN USE OR STORAGE.
FORMS BEARING SEAL, MINIMIZING LEAKAGE.
RETURNS TO ORIGINAL CONSISTENCY WHEN BEARING STOPS.

For additional information and the name of your nearest Distributor, write Standard of California, 225 Bush Street, San Francisco 20, Calif.; The California Oil Company, 30 Rockefeller Plaza, New York 20, N. Y.; The California Company, 17th and Stout Streets, Denver 1, Colo.; Standard Oil Company of Texas, El Paso, Texas.

FOR EVERY NEED A STANDARD OF CALIFORNIA JOB-PROVED PRODUCT

40 YEARS OF EXPERIENCE produced
THE NEW COULTER
AUTOMATIC THREADING LATHE





The many different and number of threading tools which can be arranged on the tool slides both front and rear, make this machine the most versatile of any for production of square, standard, and 29 degree threads, both internal and external.

Equipped with disc clutch. . . . Easy to operate. . . . Rigid Construction. . . . Four speed headstock. . . . Return or Idle travel speed has been increased five times cutting speed.

PRODUCTION MACHINES SINCE 1896
Write for full particulars

The James COULTER *Machine Co.*
BRIDGEPORT • CONNECTICUT • U.S.A.

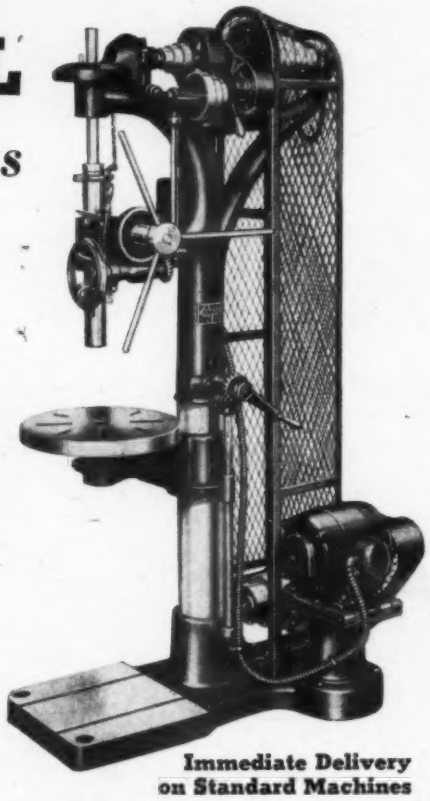
A NEW 20" DRILL
To Meet Your Requirements

FOR ACCURACY Ruggedly designed for modern production. All parts tooled for interchangeability—Spindle is forged steel and quill has bronze oil-groove bushings—Morse taper as well as table arm is bored in spindle after assembly—table surface held at right angle to spindle to .007 in 6 inches.

FOR SPEED Convenient controls with long wearing designed mechanism speeds up operator handling—reduces fatigue and chance for spoilage. Table rotates on arm, and both swing on machined column for working space on base. Automatic feed trip operates through full spindle travel.

FOR CAPACITY Power is delivered smoothly to give the Sibley 20" a capacity of 1¼" in cast iron or equivalent in other metals. Drive gears of 1:2 and large back gears of 1:4 ratios deliver ample power for every load—Castings are high-tensile, semi-steel. Motor drive is cast integral with the machine base.

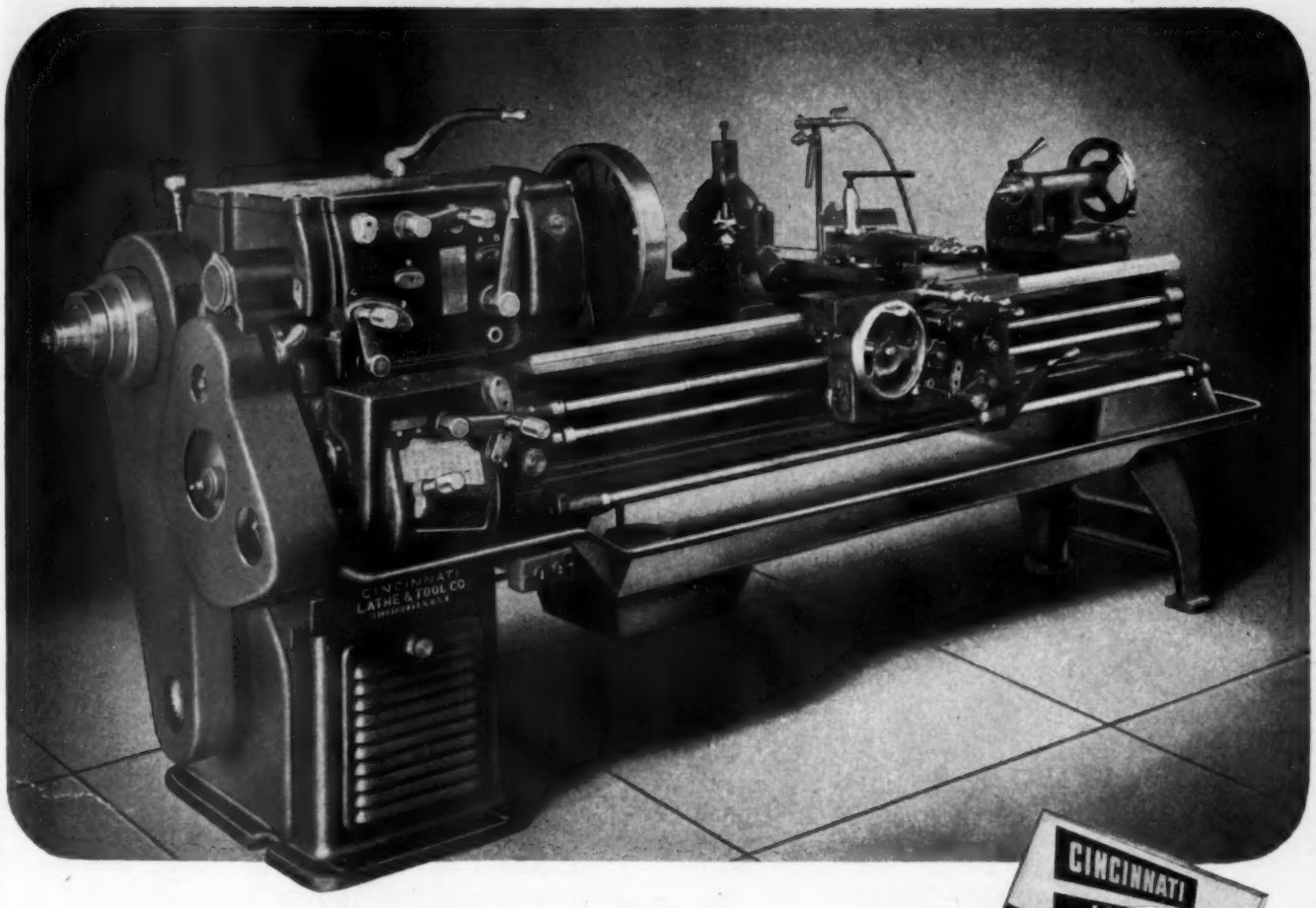
SIBLEY MACHINE & FOUNDRY CORP., 30 East Tutt Street, South Bend 23, Indiana



Immediate Delivery on Standard Machines

SIBLEY A REPUTABLE NAME IN DRILLING MACHINES

OF OUTSTANDING VALUE...



Simple to operate, incorporating time-proven features of design, these Cincinnati Lathes are real profit-making tools in maintenance, repair and general machine shops. Small lot manufacturing is also done very economically on these versatile tools.

Materials and workmanship are of the highest standards.

The wide range of swings and bed lengths enables you to select the size that will be right for your particular needs. Actual swing from 16½" to 27½", inclusive.

We will be glad to furnish you complete data, prices and deliveries.

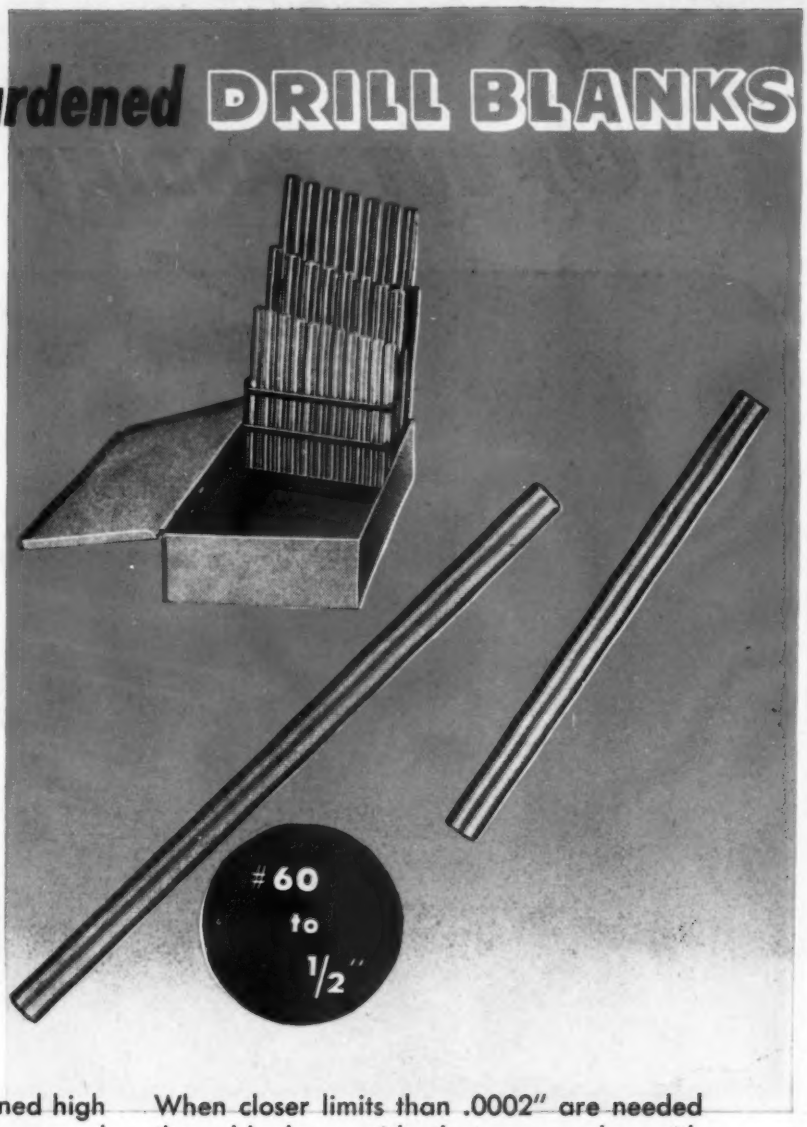
This circular will be sent on your request, and includes complete description and data on the 14", 16", 18", 20", 22", and 24" Cincinnati Lathes.

CINCINNATI LATHE & TOOL CO.

CABLE ADDRESS: CINTILATHE

OAKLEY, CINCINNATI 9, OHIO

ACE uniformly hardened DRILL BLANKS



convenient—

At your finger tips in handy Huot cases. (115 sizes from stock)

adaptable—

Used as end cutting tools, plug gages, punches, etc.

economical—

Wire sizes 1–60 $22.90
Fractional 1/16–1/2 $24.85
Letter Sizes A–Z $22.45

Drill blanks are solid bars of hardened high speed steel, drill length, centerless ground to limits of +.0002"—.0000".

They are used primarily for checking hole sizes and as raw material for fabrication into cutting tools.

Blanks are widely used as inexpensive substitutes for plug gages when a tolerance of .0002" is sufficiently close. Tolerance permitting, they may be used instead of costly gage blocks on many inspection operations.

When closer limits than .0002" are needed these blanks provide the gage maker with a ready medium for lapping to the required tolerance.

Among cutting tool applications are routers, countersinks, spot facers, reamers, end mills, tool bits, boring bar bits and blades for inserted cutters.

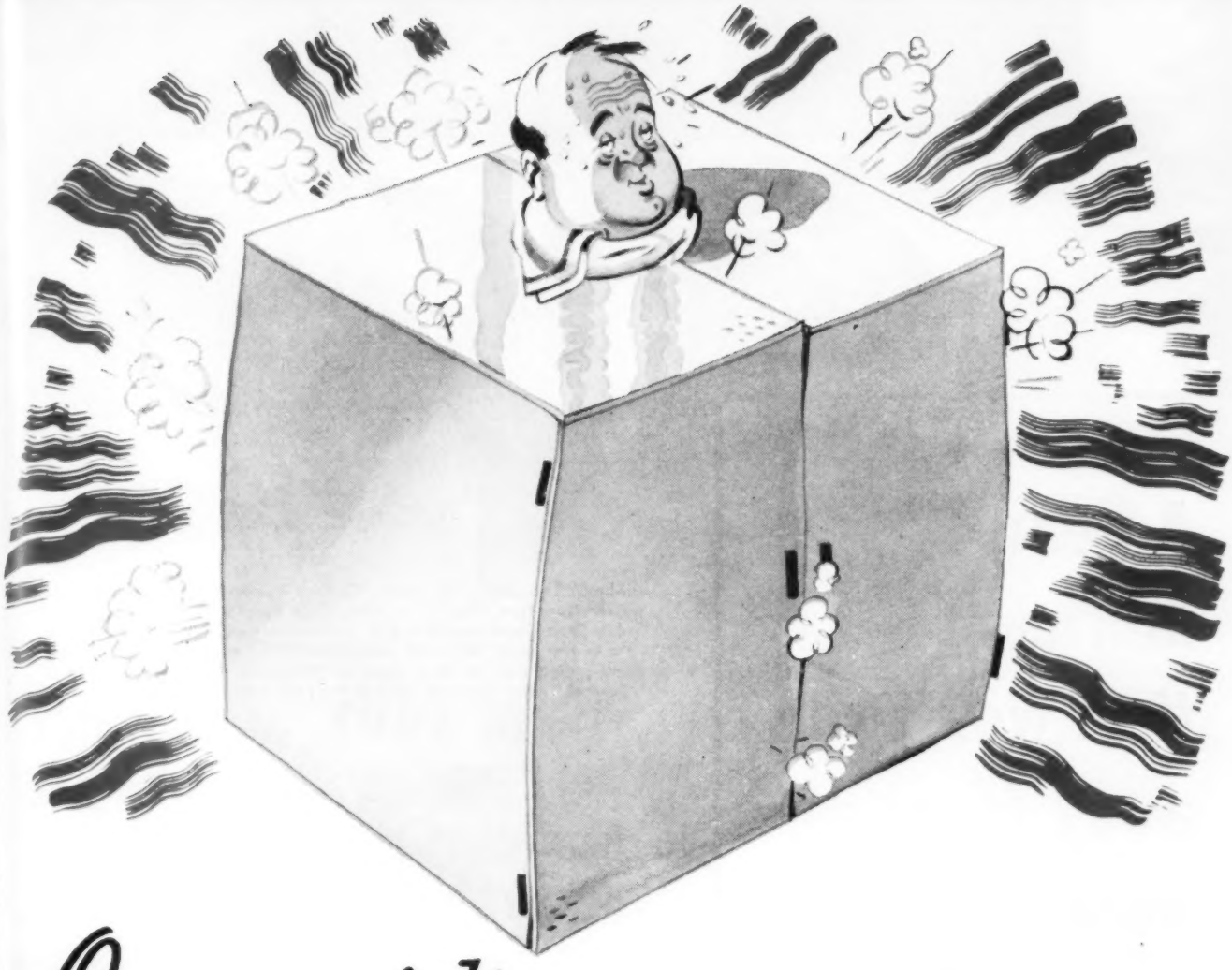
Miscellaneous uses include gear tooth gages, thread measuring wires, sine bar settings and punches.

2257

ACE DRILL CORPORATION

MANUFACTURERS OF GROUND-FROM-THE-SOLID DRILLS AND REAMERS

13835 JENNINGS STREET DETROIT 27, MICH.



Our specialty: sweating out your Cutting Oil problems!

WHAT ticklish job is bothering you? A new grinding operation? Does it take too many passes to do it? Is tool life too short? Can't you get the proper finish? Won't any cutting oil you've tried fix things up? Just drop the whole problem right in the lap of a Standard Oil Cutting Oil Specialist. You can count on him for the *right* answer!

If your plant is located in the Midwest there is one of these cutting oil specialists at the nearest Standard Oil office ready to study your cutting oil needs. There are two sound reasons why he can help you. First, he has complete knowledge of products developed by Standard Oil for practically all machine operations. Second, he has experience in applying these products in many other plants.

You'll find Standard's Cutting Oil Service the real short cut to your cutting oil answers. Standard Oil Company (Ind.), 910 S. Michigan Ave., Chicago 80, Ill.

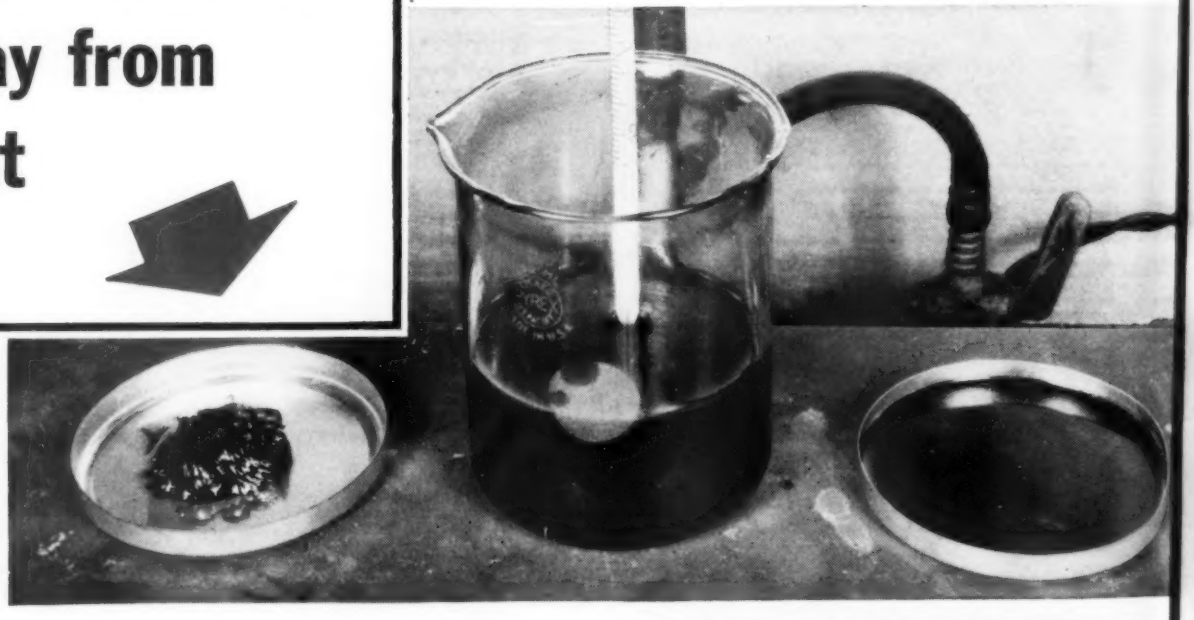
Standard's CUTTING OIL SERVICE

TANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

LUBRICATION ENGINEERING...STANDARD OIL COMPANY (INDIANA)...LUBRICATION ENGINEERING...STA

A gear lubricant that won't run away from heat

(Above) Two samples of grease, Calumet Viscous Lubricant on left and a residuum type gear shield, right. These samples are placed on a hot plate (below) and heated to 320°F. as determined by the thermometer in the beaker of oil. Within 60 seconds the old type gear shield has melted and spread over the pan. There is little or no change in structure of Calumet Viscous Lubricant even at this high temperature.



THE SIMPLE TEST described here shows why Calumet Viscous Lubricants reduce throwoff, cut lubricant consumption and protect open gears for long periods of time even though subjected to elevated temperatures.

Calumet Viscous Lubricants have these qualities because they are not the old type gear shields but are true greases made from selected soaps and oils of proper viscosities. They do not require heating before application, and all but the heaviest grades can be sprayed. Both features offer a further saving in time and grease.

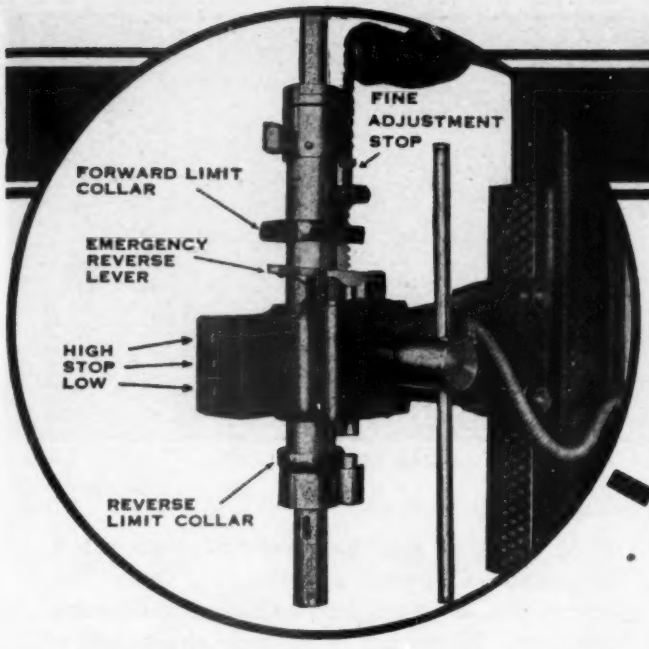
A Standard Oil Lubrication Engineer will help you select the grade you need for low cost open gear lubrication.

CALUMET Viscous Lubricants

Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

Avey FEATURE No. 1



THE Avey TYPE MA-6

AVEY-MATIC POWER FED HAND FEED AND REVERSING MOTOR TAPPING MACHINE

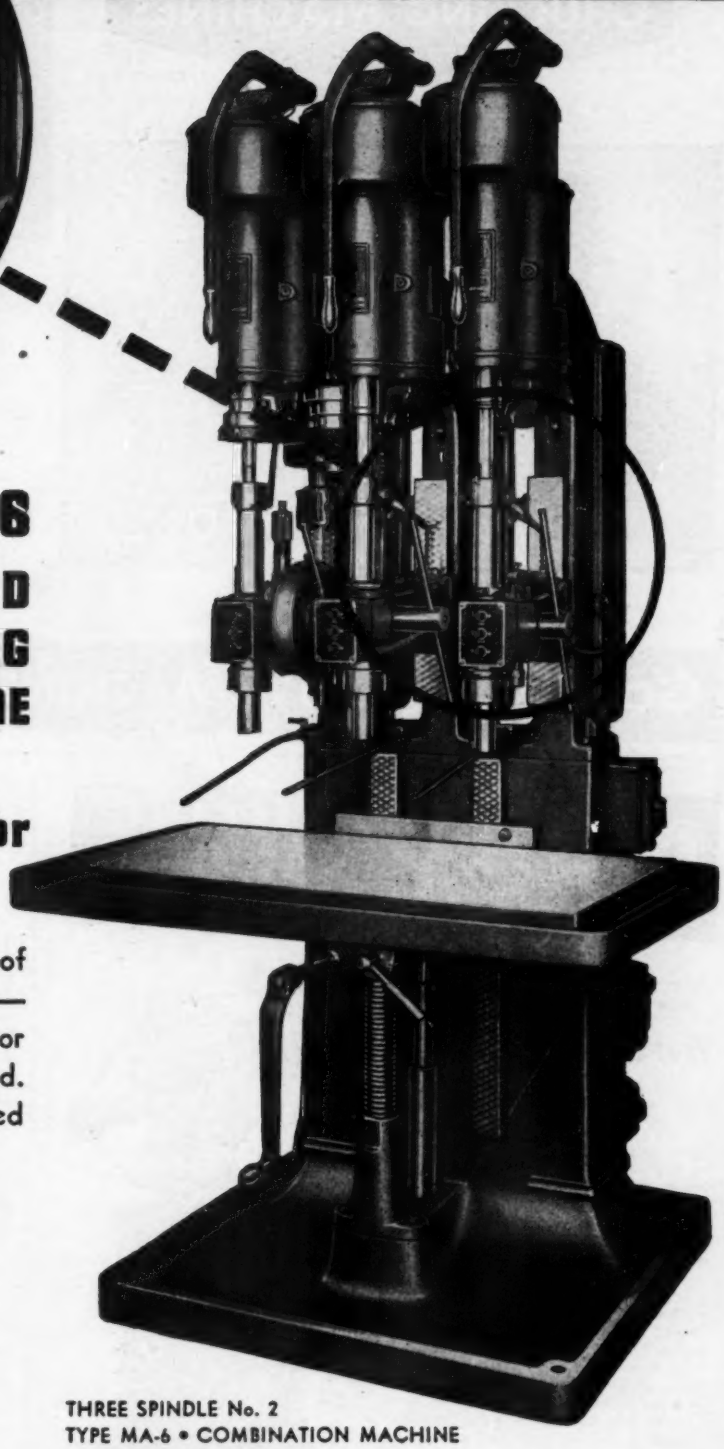
features

hand feed reversing motor for tapping

Dog control for depth — maintaining accuracy of depth within one-half revolution of the spindle — or emergency relief lever used to reverse motor if necessary before tapping cycle is completed. The natural motion of the spindle sleeve is used to control the reversing of the motor.

Type MA-6 is made in following capacities:
No. 2 — 7/8" capacity in cast iron.
No. 3 — 1 1/4" capacity in cast iron.

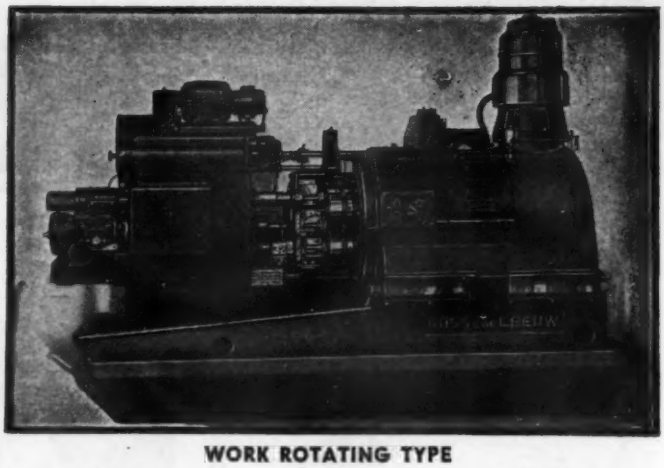
THE AVEY DRILLING MACHINE CO.
CINCINNATI • OHIO • U. S. A.



THREE SPINDLE No. 2
TYPE MA-6 • COMBINATION MACHINE
1st Spindle - Avey-matic Feed
2nd Spindle - Hand Feed
3rd Spindle - Tapping (Reversing Motor)

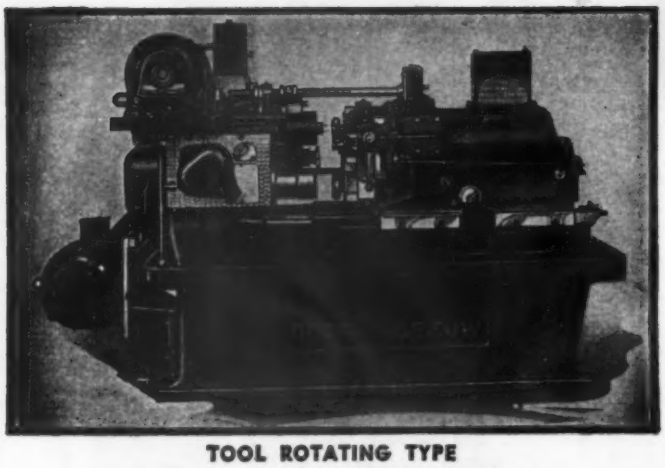
Avey DRILLING MACHINES

GOSS & DE LEEUW *Multiple Spindle* CHUCKING MACHINES



WORK ROTATING TYPE

5 Spindles • 6 Spindles • 8 Spindles



TOOL ROTATING TYPE

4 Spindles • 5 Chucking Positions

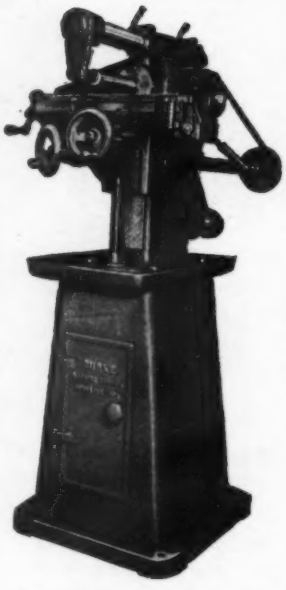
Both types of machines provide lead screw threading. Oversize spindles on these machines are mounted on pre-loaded anti-friction bearings. Ways are hardened; gears are of chrome-nickel steel, carefully heat-treated.

The many modern features offered in these machines are fully described in catalog available on request.

GOSS & DE LEEUW MACHINE CO., NEW BRITAIN, CONN.

BURKE MILLING MACHINES

. . . Put Your Small Work on a Production Basis!



Those small, difficult jobs can be handled on a *production basis* with BURKE Motor Driven Milling Machines Nos. 1, 2, 3, & 4. Primarily, this is because BURKES have been *specially designed and built* to do smaller milling jobs efficiently and economically.

Then, too, a number of attachments are available . . . attachments that increase the units usability, and add to your productivity. These include a vertical milling attachment, index centers, and vises—3 types, including swivel base. Now, when production must be stepped up, is the time to investigate the profit possibilities of BURKE Milling Machines, as applied to your work.

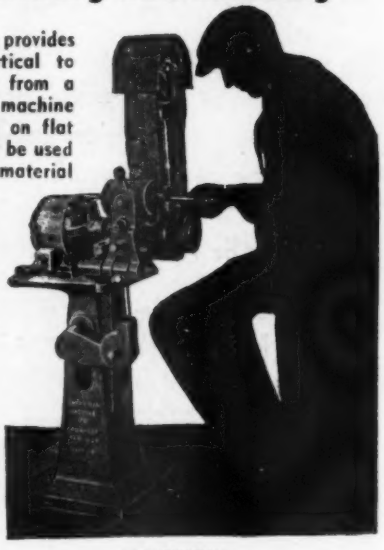
Complete Information Will Be Sent You Upon Request — Write!

BURKE MACHINE TOOL CO.

CONNEAUT · · · OHIO

THE "PRODUCTION" TYPE S replaces hand labor and speeds polishing and finishing

This Centerless machine provides quick change from vertical to horizontal converting it from a centerless feed polishing machine to straight line finishing on flat or irregular work. It may be used in either position for any material that can be ground or polished such as metals, rubber, fibre, wood, etc.



It is ideal for replacing hand labor on such work as grinding welds of tubular parts, lubricating frame parts and other cylindrical work.

High speed is assured on cylindrical work by the use of Centerless Feed Attachment which feeds work automatically without centering or chucking.

Write for illustrated literature giving complete details.

FEATURES

Feed mechanism easily swung out of way or removed.
Adjustable gage for bevels.
Belt provided with tracking device.
Automatic belt take-up.
Ball bearing equipped.
Direct motor drive.

PRODUCTION MACHINE CO.

Manufacturers of Drilling Machines, Tool Grinders and Hand and Automatic Polishing and Grinding Machines.

GREENFIELD, MASS., U. S. A.

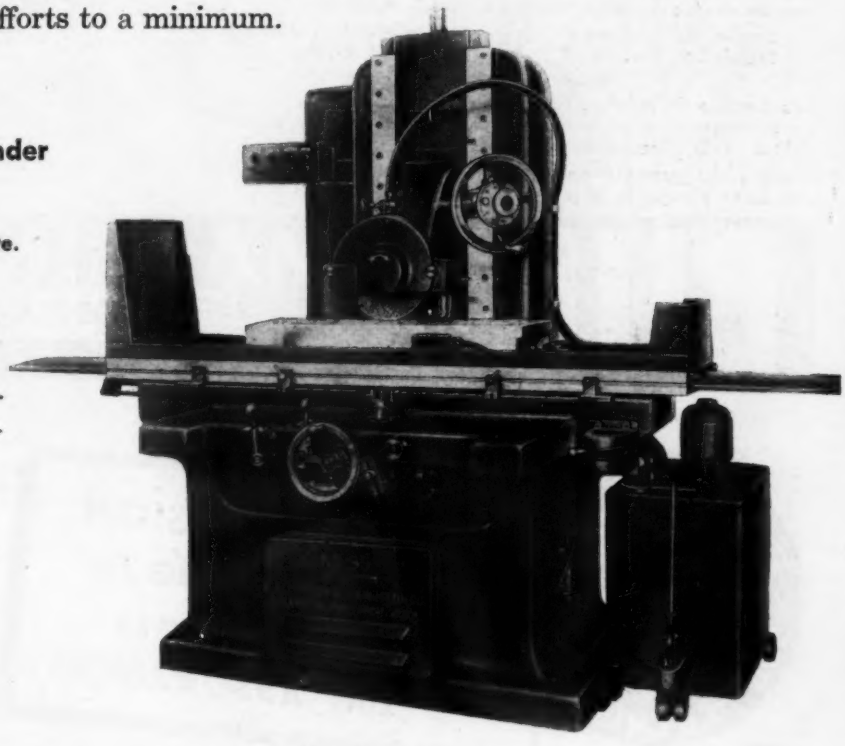
FASTER PRECISION PRODUCTION

125 feet per minute longitudinal table speed with G & L's GRAND RAPIDS No. 55 Surface Grinder

Only GRAND RAPIDS Hydraulic Feed Surface Grinders provide such exceptional table speed. Both the longitudinal table travel and the cross feed are automatic, hydraulically actuated. The wheel head is powered for rapid vertical travel. Automatic and powered movements of the Grand Rapids 55 cut the operator's efforts to a minimum. Magnetic chucks are available.

The Grand Rapids No. 55 Surface Grinder combines ALL these advantages:

- ★ **Longitudinal table speed of 125 feet per minute.**
- ★ **Integral cast column and base assures permanent alignment of vertical head ways and cross saddle ways.**
- ★ **Starters, controls and motors easily accessible.**
- ★ **Two spindle speeds, reduce wheel costs.**
- ★ **Patented vertical movement of wheel head.**
- ★ **Bijur one-shot lubrication system.**
- ★ **Special G & L spindle motor end-bells and over-size precision ball bearings.**
- ★ **Vickers vane type hydraulic pump.**
- ★ **Portable, self-contained motor-driven coolant system.**



SPECIFICATIONS:

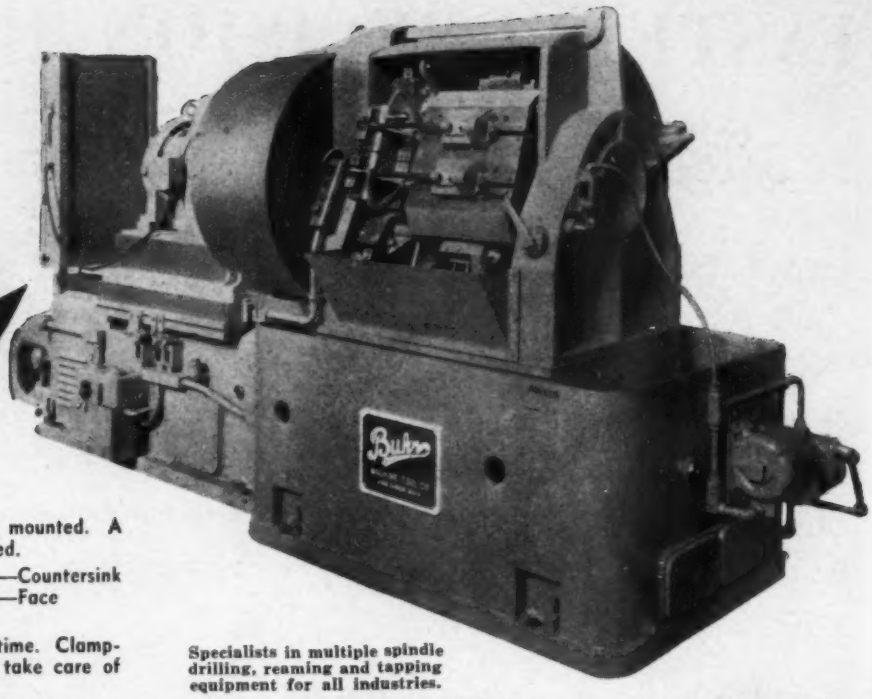
Automatic Table Travel—longitudinal 38″, transverse 13½″.
Working surface of table—12″ x 36″.
Standard wheel size—12″ x 1″ x 3″.
Vertical movement of wheel head—18″.
Spindle speeds—1925 and 2500 RPM.
Floor space—150″ wide x 102″ deep.

Write for catalog GL 101

What "GRAND RAPIDS" Quality Means: G & L cast their own close-grained gray iron, machine all parts to micrometric tolerances, and precision-assemble grinding machinery of unsurpassed performance. *Grand Rapids* means *top* quality in Hydraulic Feed Surface Grinders.

GALLMEYER & LIVINGSTON COMPANY, 330 STRAIGHT ST., S. W., GRAND RAPIDS 4, MICH.

18 Different Tie Rods DRILLED With This MACHINE !!



A Hydraulic unit on which an 8-spindle head is mounted. A base on which a 5-station trunnion fixture is mounted.

Station No. 1—Load
Station No. 2—Drill
Station No. 3—Countersink
Station No. 4—Face
Station No. 5—Ream

Two steering tie rods are clamped in fixture at a time. Clamping arrangement is so that it can be adjusted to take care of eighteen (18) different tie rods.

Safety device prevents machine from being started until trunnion index plunger is in place.

Specialists in multiple spindle drilling, reaming and tapping equipment for all industries.

Send blue prints of parts. We'll help solve your production problems.

All gears shaved and induction hardened.

BUHR MACHINE TOOL CO.

GREEN & DAVES STREETS
ANN ARBOR, MICHIGAN

PRECISION REID SURFACE GRINDERS

REID'S PRECISION MANUFACTURING for over 46 Years Is Your ASSURANCE

IT'S PROVEN!

The "Know How" experience gained over this long period is built into every REID PRECISION SURFACE GRINDER.

BECAUSE OF DEPENDABLE ACCURACY ECONOMICAL PRODUCTION CONTROLS AT YOUR FINGERTIPS

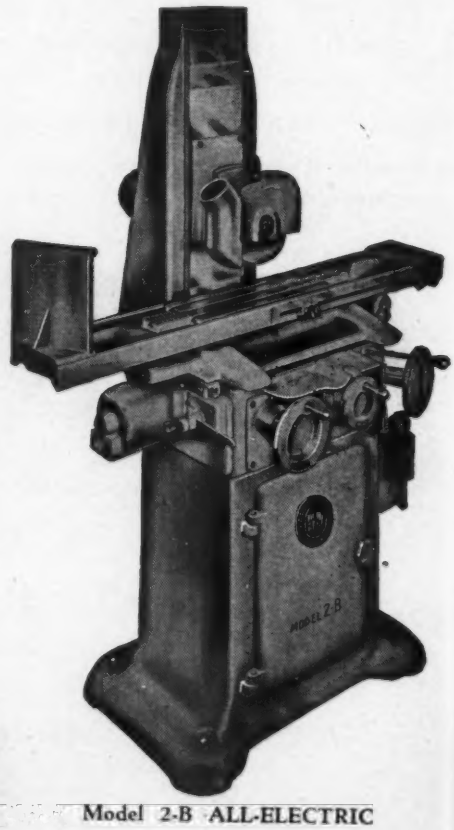
Leading shop men everywhere say,

"for Close Tolerance, use a REID!"

The Reid Model 2-C Hand-Feed also is an exceptionally fine machine for tool, gage, die and certain production grinding. Machines equipped for wet grinding if required.

EXCELLENT DELIVERIES—Distributors in All Sections.

Write to Dept. H for illustrated bulletin and prices.



Model 2-B ALL-ELECTRIC

REID BROTHERS COMPANY, INC.

BEVERLY MASSACHUSETTS

SHELDON precision

SHELDON S-56
11¼" swing
1" collet capacity
56" bed

SHELDON *precision* is of the new type; is the precision of modern manufacturing methods —a specially designed machine tool plant, tooled to the nth degree with the finest machine-tool building equipment. From this plant come precision lathes, milling machines and shapers—quality machine tools built to the closest tolerances on a quantity production basis much like a fine aircraft engine.

Possibly equally accurate tools can be built "by hand" but only at far greater cost.

That is why SHELDON can always give "more tools for the money"—more accuracy, more capacity, more features and inherent quality. That is why it is always smart to "See the Sheldon at your distributors before you buy."

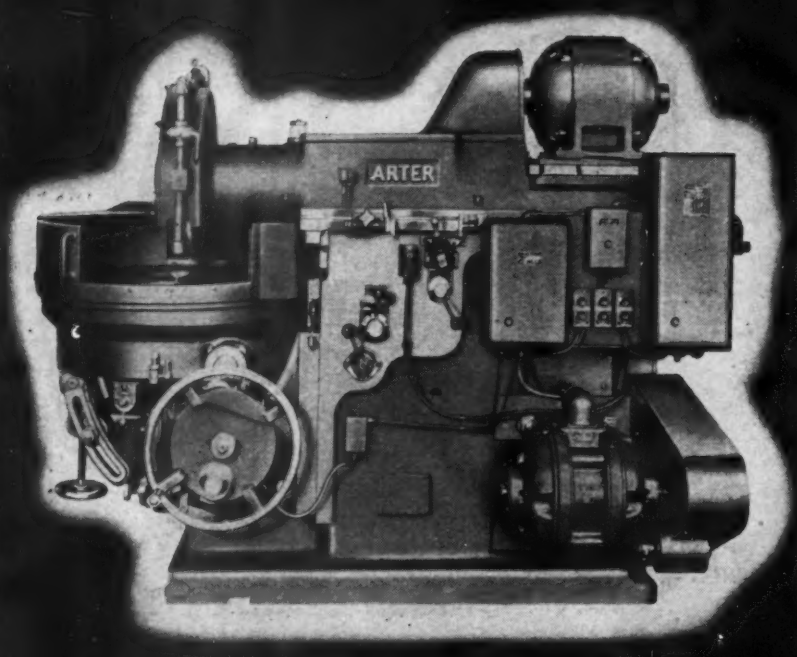
Write for Catalog

See Our Exhibits at "Metal Show" Atlantic City, Nov. 18 to 22
"Power Show" New York Dec. 2 to 7

SHELDON MACHINE CO. Inc.

Manufacturers of Sheldon Precision Lathes • Arbor Presses • Vises
Sheldon-Vernon Horizontal Milling Machines • Vertical Milling Machines and Jig Borers • Shapers
4234 N. KNOX AVENUE • CHICAGO 41, ILLINOIS U.S.A.

ARTER



Model B 20" 24" 30" 40"

Motor-on-head construction is now standard on ARTER MODEL B ROTARY GRINDING MACHINE, delivering the maximum power of the motor to the spindle. MODEL B ARTER ROTARY GRINDER makes heavy roughing cuts as well as fine feeds necessary for fine finish and accurate sizing.

Arter Gives You Versatility

ARTER GRINDING MACHINE COMPANY

WORCESTER, MASSACHUSETTS • U. S. A.

KEYSEATING

The Modern Way

Illustration shows typical set-up for cutting taper keyways with table tilted.

Machines are made in three sizes for keyways 1/16" to 1¼" in width.

Great simplicity and ease of operation of Davis Keyseaters assure the user of accurate, time saving work.

Let our engineer study your keyseating problems.

DAVIS KEYSEATER COMPANY

403 EXCHANGE ST. ROCHESTER 8, N. Y.

LIKE THE COUNTRY DOCTOR

WE'VE BEEN CURING ILLS FOR A LONG, LONG TIME

Our line might be a shade different from the country doctor's but it surely parallels his. For 40 years we've been prescribing the right machine tools, and we'd appreciate this opportunity to help you. No job is too big for us to handle, or too small to receive our closest attention. Call on us any time.

JIGS • FIXTURES • SPECIAL TOOLS
BUILDING COMPLETE MACHINE TOOLS
UNITS FOR MACHINE TOOLS
PUNCHES AND DIES

COLUMBUS DIE·TOOL and Machine Co.

940 CLEVELAND AVE.
COLUMBUS 1 OHIO
ESTABLISHED 1906

You can cut off tubing with one finger!

ETNA

Tube Cutoff Machine

THE TUBE REMAINS STATIONARY.... IT'S THE CUTTER HEAD THAT ROTATES

•

The entire cutoff cycle—clamping of tube, cutting off and unclamping is completely automatic.

SINGLE PUSHBUTTON CONTROLLED

What are you doing about tube cutting

?

THE ETNA MACHINE CO., TOLEDO 10, OHIO

SIGOURNEY M-100

MAINTAINED ACCURACY IN PRECISION WORK

The Sigourney M-100 Bench Drilling Machine is extremely accurate on precision jobs. It is unusually sturdy and rigid in construction . . . has hardened and ground spindles . . . and sealed ball bearings throughout. All moving parts are entirely closed for maximum operator safety. M-100 is built for long and steady service.

This sturdily constructed bench drilling machine is available in 1, 2, 3 and 4 spindle models . . . speeds from 4,000 to 10,000 r.p.m.

Send for Illustrated Bulletin

THE SIGOURNEY TOOL CO.
Hartford 6, Conn.

Sole Sales Agents

PRATT & WHITNEY

Division Niles - Bement - Pond Co. - - - West Hartford, Connecticut

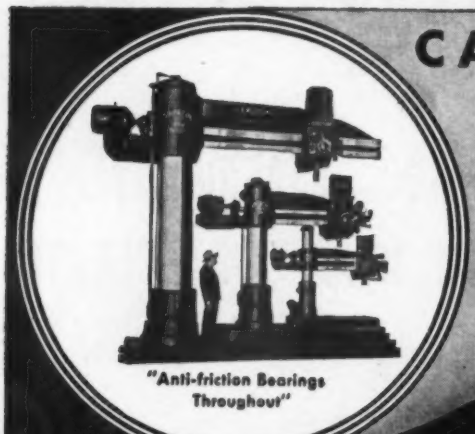
PORTAGE

HORIZONTAL BORING, DRILLING AND MILLING MACHINE NO. 4

• Featuring an extended saddle and table with outer rail support for maintaining exceptional accuracy on long work. Get fully acquainted with the many features of this modern Boring Mill. *Ask for a copy* of our new instructive bulletin which points out the numerous advantages of this new Horizontal Boring, Drilling & Milling Machine.

THE PORTAGE MACHINE CO.
1029 SWEITZER AVENUE, AKRON, OHIO

CARLTON RADIAL DRILL



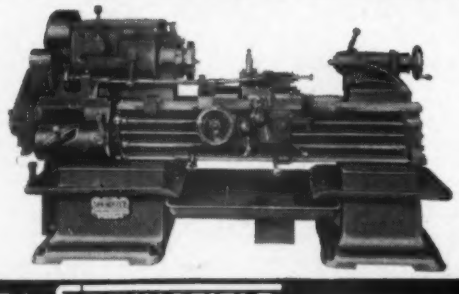
"Anti-friction Bearings Throughout"

FEATURES — 1. Low Hung Drive to the Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all speeds. 4. Concentrated and Convenient controls. 5. Constructed on Unit Principal.

The **CARLTON**
MACHINE TOOL COMPANY
CINCINNATI, OHIO, U. S. A.

ARMY E NAVY

SPRINGFIELD GEARED HEAD LATHES



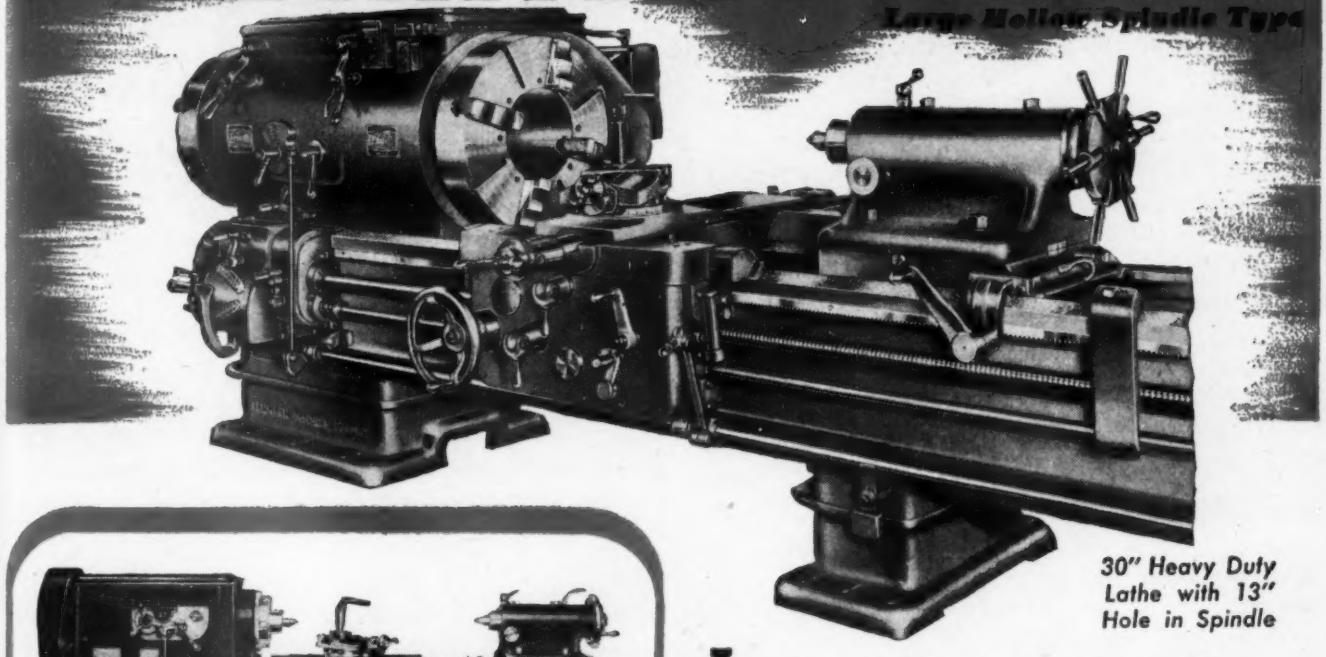
. . . versatile, efficient!

Springfield designs lathes to retain accuracy and speed over long periods of use. For quantity production or special use they're economical and extremely adaptable. Sizes available range from 14" to 30". *Write for descriptive bulletins, prices and deliveries.*

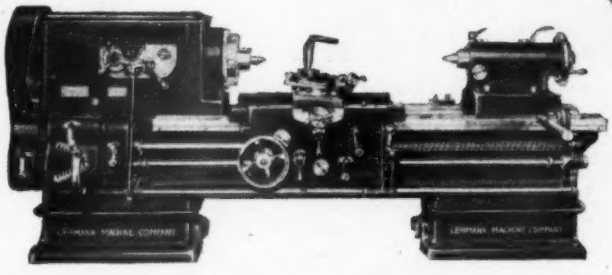
The SPRINGFIELD MACHINE TOOL COMPANY • • • SPRINGFIELD, OHIO, U.S.A.

Do it Better!... on a HYDRATROL LATHE

Large Hollow Spindle Type



30" Heavy Duty Lathe with 13" Hole in Spindle



Standard Type, Heavy Duty HYDRATROL LATHES, 20" to 36"

The big 27" size, shown above, has all the ruggedness and power for the heaviest possible work. And its many refinements in design and construction result in an ease of operation comparable to small machines.

In hundreds of plants—under all sorts of conditions—LEHMANN HYDRATROL LATHES have invariably brought about faster production, better work, lower costs.

Look around your own shop—you may find a number of machining jobs which possibly could be done better on a Large Hollow Spindle Type of HYDRATROL LATHE. Send us prints of these unusual, difficult, or too-costly machining jobs, for a specific, time-and-money-saving recommendation.

Five Sizes - 18" to 36"

Small	18" up to 7⅛" Hole
Medium	24" up to 12⅛" Hole
Large	27" up to 13⅛" Hole
Large	30" up to 14⅛" Hole
Large	36" up to 16½" Hole

(Standard type lathes, 16" to 36")

Lehmann MACHINE COMPANY

CHOUTEAU AT GRAND • • • ST. LOUIS 3, MISSOURI

H&G Insert Chaser DIE HEADS

Choice of experienced
SCREW MACHINE MEN

The makers of H & G Insert Chaser Die Heads learned from an independent survey the die head preferences of leading production engineers and operators. H & G was number one by a substantial margin. Here are the reasons for this preference direct from reports: "*simplicity of construction . . . positive cam action.*" Another, "*ease with which chasers are changed . . . set to proper pitch diameters . . . quickly resharpened.*" (This reason occurred again and again.) From another report, "*they are ideal for threading close to shoulders.*" Another, "*interchangeability of insert chasers for different types of die heads reduces inventory and is a distinct advantage.*" Another writes, "*more threads per grind and more parts per hour for man and machine because of less down time.*" And this one (if you will pardon us): "*we like the cooperation of the company.*"

● Why don't you change to H & G Die Heads?

SPEED CALCULATOR

This handy device eliminates laborious calculations and gives the proper speeds for different materials for all diameters. FREE if requested on business letterhead. Otherwise, 15c.

Simple
Strong
Accurate

Sizes and styles for all machines on which threads are cut. Write for literature.

THE EASTERN MACHINE SCREW CORP.
20-40 Barclay Street, New Haven, Conn.

Manufacturers H & G General Purpose Die Heads, Insert Chaser Die Heads, Threading Machines, Feed Fingers

HYNDMAN Brazing SERVICE
. . . FOR FABRICATING AND JOINING METAL ASSEMBLIES AND METAL PARTS OF EVERY KIND
BY FURNACE
with Silver and Copper
BY . . . INDUCTION
with Silver Solder
BY TORCH
with Silver Solder
AN IMMEDIATE ANSWER FOR
1. DEFINITE IMPROVEMENTS IN YOUR PRODUCT QUALITY
2. INCREASED SPEED OF YOUR PRODUCTION
3. REDUCED COST OF YOUR PRODUCTION
BRIGHT ANNEALING
INDUCTION HARDENING
A. H. HYNDMAN COMPANY, INC.
CHICAGO 28
ILLINOIS

Bulletin describes the **HYNDMAN** *complete, dependable, money-saving* **BRAZING SERVICE...**

Send for your copy now

See illustrations and read about some of the various brazing jobs we have done. See why our experience and facilities equips us for serving you even though yours is a complicated assembly.

Through our service you insure definite improvements in your product quality as well as cutting the costs of your production. Our service includes BRIGHT ANNEALING and INDUCTION HARDENING.

A. H. HYNDMAN CO., INC.
9603 COTTAGE GROVE AVE. CHICAGO 28, ILL.

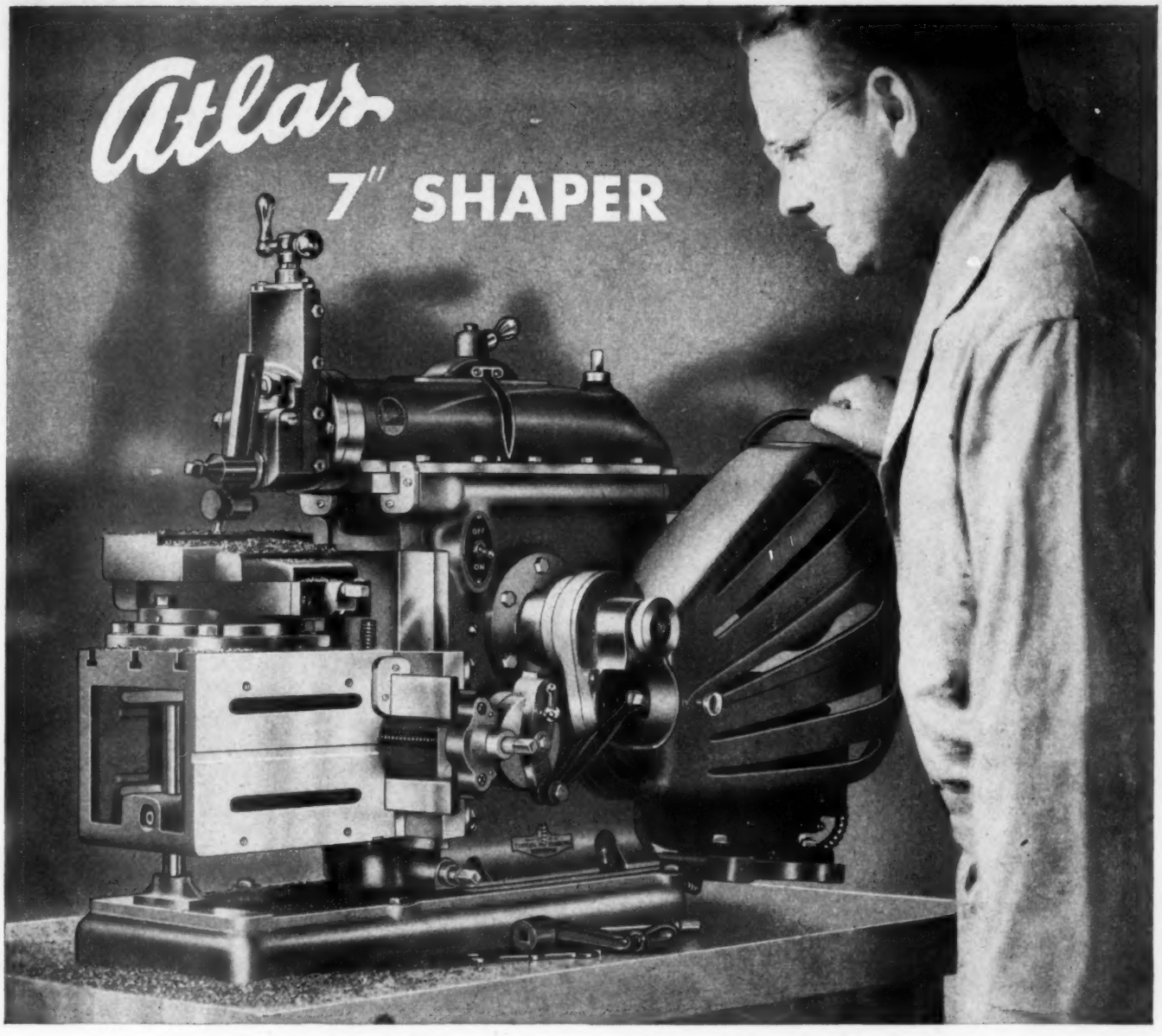
IF **YOUR** JOB REQUIRES

Lifting

you can use **Portelvator** to endless advantage. • Portelvator, (The Hamilton Tool portable elevating table) is a rugged worker. Built to take years of abuse under actual operating conditions. • Used as a level under overhanging work; as a portable work bench; to charge and discharge heat treating furnaces.

Used in toolandstockroom, in loading and unloading. • Standard models lift and carry loads up to 5,000 lbs. Special models designed and built to solve particular problems. • Write for descriptive literature. You'll be glad you did! Address Department D-P.

THE *Hamilton* TOOL COMPANY
SUPER SENSITIVE DRILLING MACHINES · TAPPING MACHINES · PORTELVATORS
NINTH STREET AT HANOVER · HAMILTON · OHIO · U·S·A



QUICKER SET-UPS on SMALL PARTS Operations

"Match the machine to the job" is an idea that is especially valuable in shaping operations. Most of them are within the 7" stroke of the Atlas shaper. You can save considerable on set-up time, machine hour and power costs with this compact low cost tool.

The Atlas shaper handles close tolerance work to perfection. Gives you a selection of cutting strokes between 45 and 186 per minute, speeds from 3-1/2 to 116 fpm. It is Timken bearing equipped. Operates from ½ HP motor.

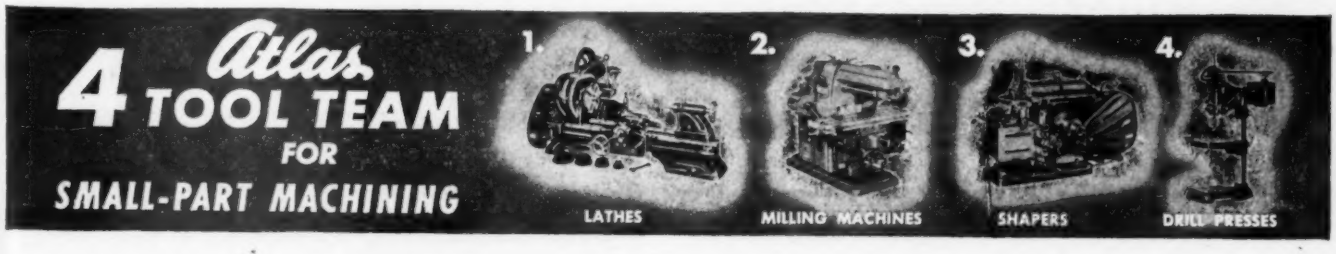
PROMPT DELIVERY!

Based on current production increases —unless this "announcement" swamps us —your Atlas distributor can have a Shaper in your plant in a few weeks after you place your order.

Send for catalog with complete specifications and operating details.

ATLAS PRESS COMPANY

1104 North Pitcher Street, Kalamazoo 13D, Michigan



This new Bulletin

...MAY SAVE YOU HUNDREDS OF DOLLARS ON SMALL PARTS PRODUCTION!

WRITE TODAY FOR YOUR FREE COPY

Ask for Bulletin No. 31

Just printed, this bulletin tells the complete story of the versatile Ettco-Emrick System and Equipment that assure maximum production of drilled and tapped holes in small parts, at minimum tooling cost.

ETTCO TOOL CO.

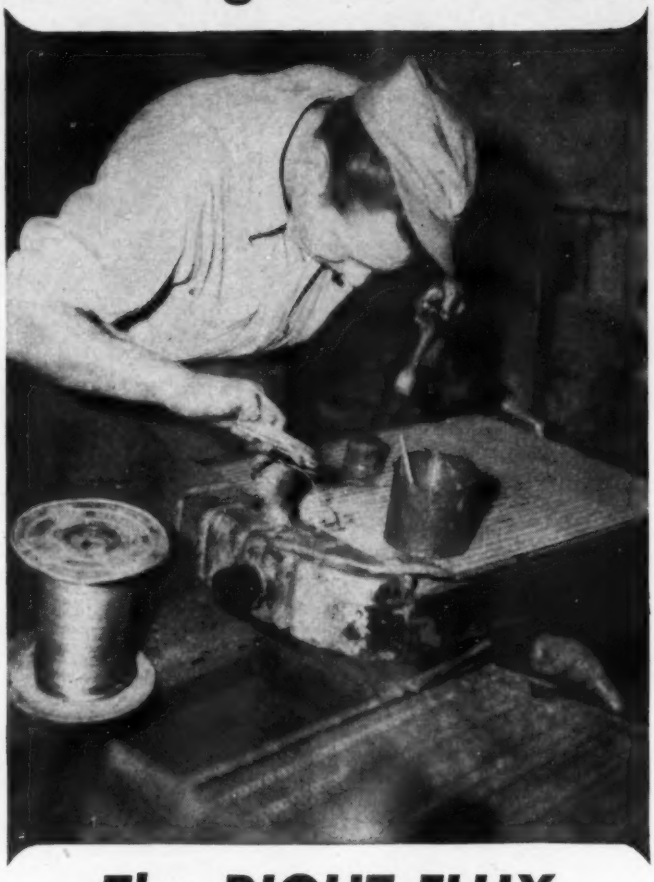
590 Johnson Ave., Brooklyn 6, N. Y.

DETROIT 1 • CHICAGO 6

The Famous Ettco-Emrick **DRILL CHUCKS • TAP HOLDING CHUCKS**
TAPPING ATTACHMENTS • TAPPING MACHINES
MULTIPLE SPINDLE TAPPING AND DRILLING HEADS
Unexcelled for Design, Materials and Workmanship

KESTER FLUXES

Take Tough Jobs in Stride



The RIGHT FLUX for every solder job!

• There's a wide difference in solder fluxes . . . where one works perfectly another won't, and vice versa. If there is a soldering operation in your production that requires a separate flux, you can depend on Kester to supply exactly the right formula to do that job best.

• For nearly half a century Kester engineers have specialized on solder. In the field and in the laboratory they have studied, and supplied the exacting needs of industry.

• Their huge fund of experience and knowledge is at your disposal. Write Kester fully, at any time and without obligation, for prompt assistance on any solder question.

KESTER SOLDER COMPANY
4223 Wrightwood Avenue, Chicago 39, Illinois
Eastern Plant: Newark, N. J.
Canadian Plant: Brantford, Ont.

KESTER
Solder Fluxes
STANDARD FOR INDUSTRY

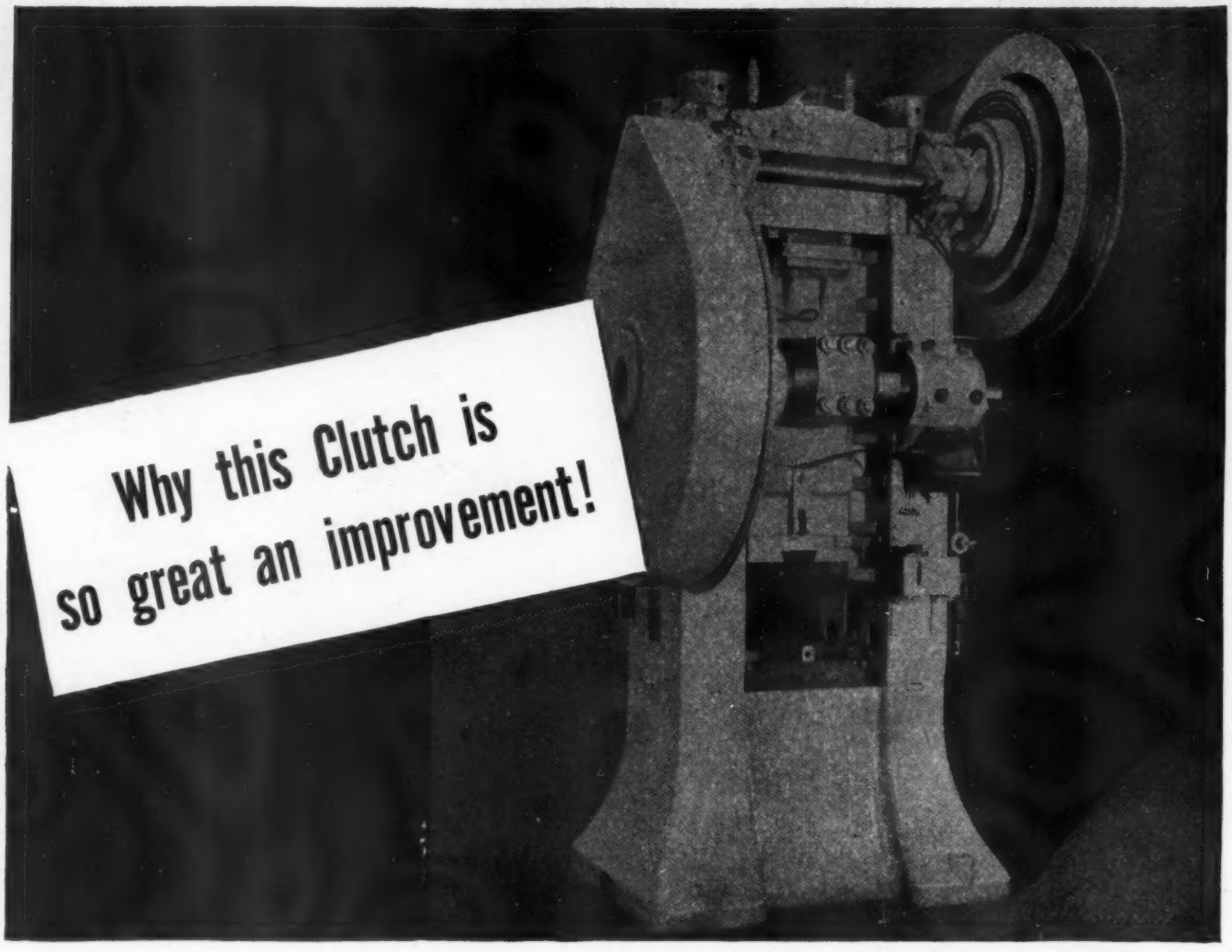
Every Tool Room
needs at least one of these sets

GAIRING Counterbore Sets provide the cutters and pilots required for ALL counterboring, countersinking and spot-facing operations within their size range. Each of the seven sets, ranging from small to large, contains a logical assortment of interchangeable holders, pilots and cutters neatly fitted into stout wooden cases . . . HOLDERS are furnished with Morse tapers or straight shanks. PILOTS are of selected alloy steel hardened and ground on the head. Shanks are treated to obtain unusual toughness and strength . . . CUTTERS, of high speed steel, are renewable and the sizes selected for sets are of the most active sizes used. Replacements are quickly made from stock.

Write today for four-page counterbore folder describing and pricing all seven sets.

THE GAIRING TOOL COMPANY
Roosevelt Park Box 478, Detroit 32, Michigan

GAIRING TOOLS



Knuckle Press with Fawick Clutch Element on Service Clutch

All clutches cost money to buy, but the Fawick Airflex Clutch costs a great deal less than others to operate and to maintain.

It works on the same principle as your tires, which are both clutch and cushion between the car and the road.

Inflate the Fawick Clutch and it engages—deflate and it releases—you control the air pressure to suit operating conditions.

A constant cushion of air protects both prime mover and driven unit, by absorbing shock and vibration.

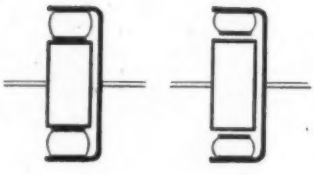
There are no springs, arms or levers to wear or break, no adjustments needed, no lubrication required.

Acts as clutch, slip-clutch, brake, coupling or power take-off—in thousands of heavy service installations.

Write us for engineered recommendations—to fit your equipment.

FAWICK AIRFLEX COMPANY, INC.
9919 Clinton Road • Cleveland 11, Ohio

In Canada, Reynold-Coventry Ltd., Montreal, Toronto, Vancouver
In Britain, Crofts Engineering, Ltd., Bradford, England



How the FAWICK AIRFLEX CLUTCH Works

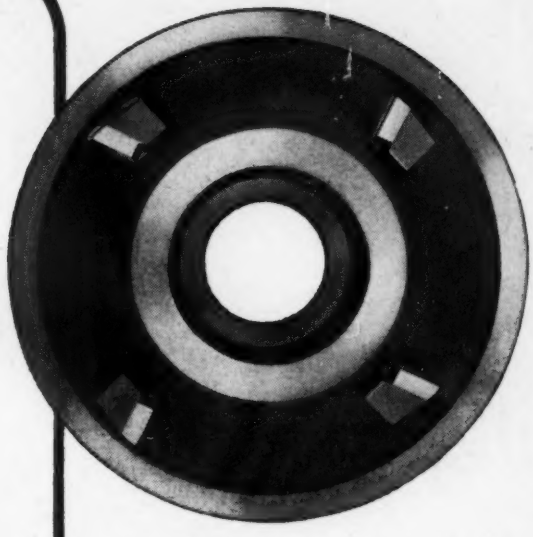
Compressed air expands the rubber - and - fabric gland to engage clutch with any degree of "grip" you want. Release the air and clutch disengages.

FAWICK
Air flex
CLUTCH

ANOTHER NEW LOVEJOY

CARBOLOY TIPPED CEMENTED CARBIDE **TOOL-BIT-TYPE**

"CUTSALL" STEP TOOTH MILL

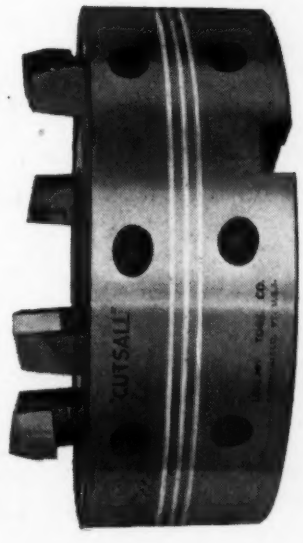


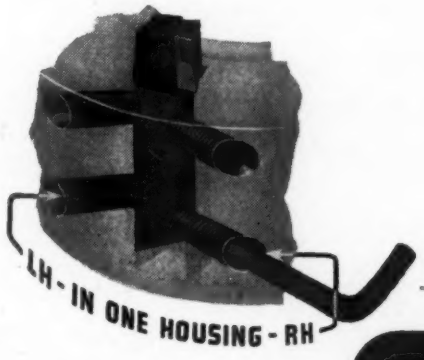
Here's another new "Cutsall" to cut your milling costs. The staggered teeth give the results of four single fly cutters—with metal removing ability that will outstrip anything you've ever tried.

Lovejoy "Cutsall" mills have large Carboloy tool-bit-type blades that can be supplied for right- or left-hand cutting, *with the same housing.* The blades can be ground easily to obtain positive or negative rake. The rear on each blade is tapered so that fine adjustment is easily made with rear set screw—front set screw securely locks the blade in the housing. (See phantom view, below.)

"Cutsall" face and step tooth mills are available in 6", 8", 10" and 12" sizes—*all take a single blade size*—all will give performance unmatched by any other mills. Write for details and prices.

- POSITIVE and NEGATIVE RAKE, RIGHT and LEFT
- HAND in ONE HOUSING
- FINE BLADE ADJUSTMENT
- EXTRA LARGE CARBOLOY TIPS





LOVEJOY
TOOL COMPANY, INC.
Springfield, Vermont, U. S. A.

IN AN ENGINEERING DEPARTMENT ORGANIZED
To Better Serve You.

Every broach, because it is designed to do a specific job, is fully dependent upon sound engineering for successful operation. The proven ability of Detroit Broach engineers is assurance to you that their tooling will do the job accurately and economically.

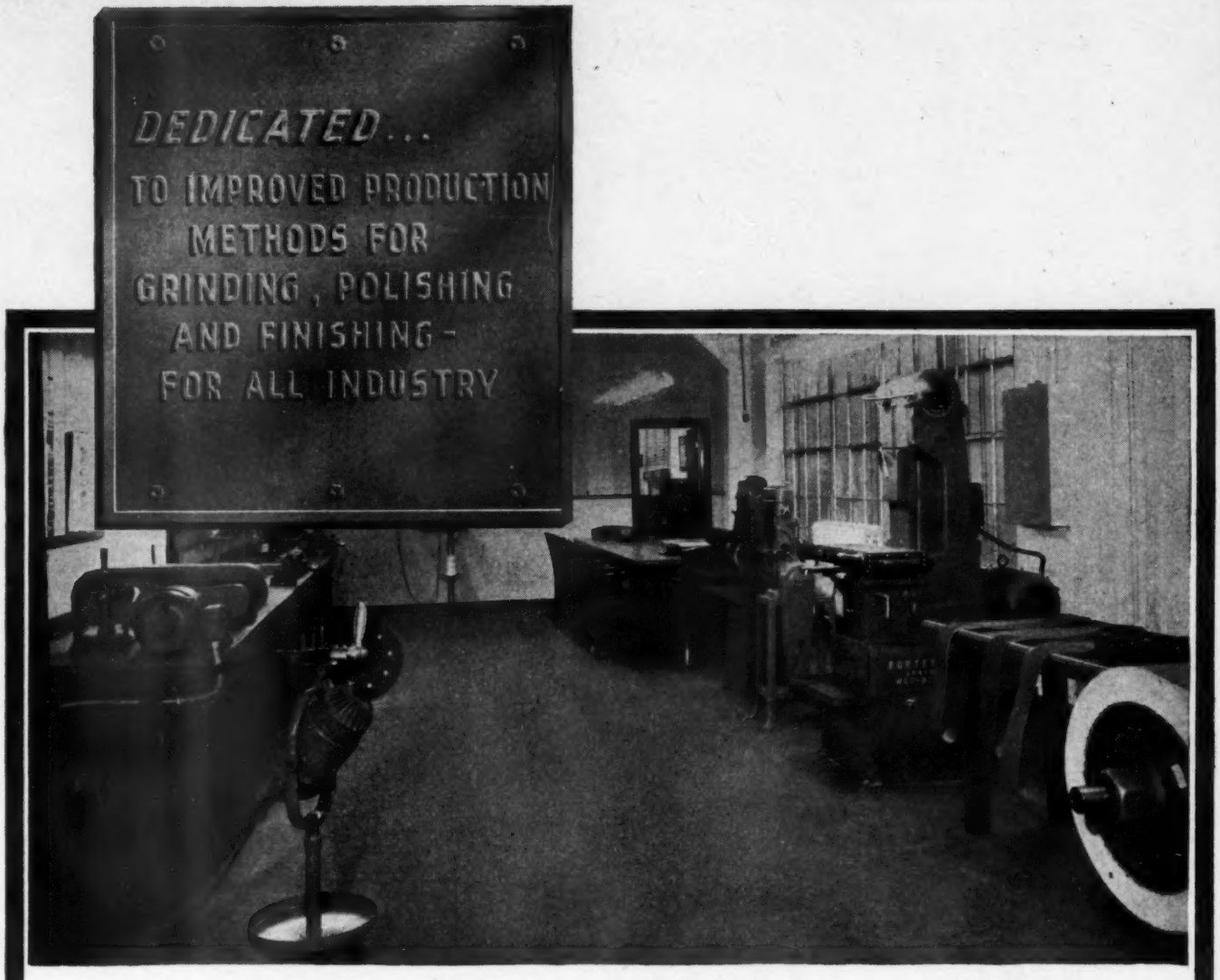
The engineering staff at Detroit Broach Company devotes its efforts to the design of broaches and broaching fixtures exclusively. These men are qualified to solve the most difficult of broaching problems—and doing so, have developed some of the great advancements in broaching application and technique.

Consult Detroit Broach regarding *your* broaching problems. This dependable service is available to you everywhere in the United States through Detroit Broach representatives who will give prompt attention to your every requirement.

MEMBER BROACHING TOOL INSTITUTE

DETROIT *Broach* COMPANY

20201 SHERWOOD AVENUE • DETROIT 12, MICHIGAN



LAB-TEST YOUR TOOL-UPS . . . *LOCALLY*

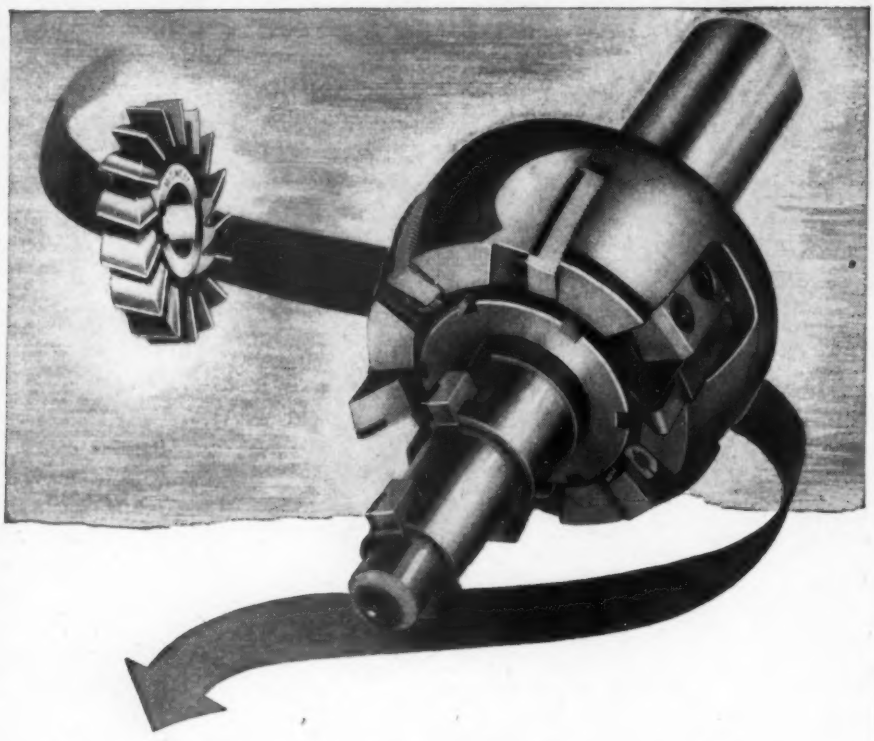
BOSTON
CHICAGO
CINCINNATI
CLEVELAND
DETROIT
NEW YORK
PHILADELPHIA
ST. LOUIS
TROY

Abrasive engineering, to effectively increase man-hour production must include the recommendation and demonstration of abrasive equipment as well as the abrasive itself. To this end, Behr-Manning has pioneered a new abrasive engineering service—branch-located methods and equipment demonstration rooms—for lab-testing tool-ups, locally.

Inaugurated last winter, this service has been recently augmented by the opening of additional demonstration rooms at our branches in New York, Philadelphia and Cincinnati.

May we suggest that you too may find this service helpful in either improving some present abrasive operation or in simplifying some non-abrasive method through conversion to abrasives. Write or phone our nearest branch or write for booklet, "Your New Laboratory, Sir."

BEHR-MANNING • TROY, N.Y.
(DIVISION OF NORTON COMPANY)
QUALITY COATED ABRASIVES SINCE 1872



Now-here is what we're trying to put across--something that may be helpful to you...

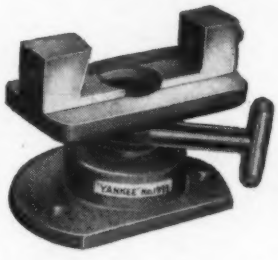
The two samples shown above are metal cutting tools—one a simple standard milling cutter, the other a very special cutter that does six operations at one time. Midwest designed them, engineered them, produced them. They're shown to give you a quick idea of the extensive range of Midwest tools. They lead us to the message we want to put across.

To begin with, and as you suspected, the message comes from the Midwest Tool & Mfg. Co., location W. Jefferson at Travis, Detroit 16, Mich., when you want to write and find out just what help we can be when it comes to metal cutting tools.

We want you to write us about tooling problems you may have, little or big. They always involve production rates, costs, operations and all the other tooling factors, particularly on special set-ups, which make the difference between profit and loss in manufacturing. We've been in this metal cutting tool business over 35 years. The 35 years provide quite a bit of experience to draw upon. They give us something to offer you—something to help solve your metal cutting problems. Why not consult us now?

By the way — ask for this general metal cutting tool Bulletin 1041—one of several interesting bulletins published by Midwest.

"YANKEE VISES



hold the work all the way through

With a "Yankee" Vise you align the work just once, no matter how many steps the job takes. Lifts on and off a swivel base. Use it on the swivel base for bench work. When removed, fits milling machine table or drill press bed. Accurately machined top, bottom, sides and front end. Makes handy, economical jig. V-grooved block for round stock. Four convenient sizes of "Yankee" Vises, with or without swivel base... 1½", 2", 2¾" and 4" jaw widths. Your industrial distributor has them. Full details about these and other handy shop tools in the "Yankee" Tool Book. Write for it today.

V-grooved block

NORTH BROS. MFG. CO.
Division of The Stanley Works
Philadelphia 33, Pa.

NATIONAL REAMERS

The Importance of Proper Selection

In choosing reamers, such factors as the materials to be reamed, the amount of stock to be removed, and the degree of accuracy and finish required should receive primary consideration. NATIONAL Reamers include such varied types as Taper Reamers, Chucking Reamers, and Shell Reamers, to mention only a few, each designed for a specific use.

Your NATIONAL Distributor can help you select the Reamer best suited to your needs. Consult him on all your metal-cutting problems.

Call Your

DISTRIBUTOR!

Leading distributors in every section of the country have stocks of National Cutting Tools. Every National distributor offers factory-trained engineers to serve you. Call your National distributor for cutting tools or any staple industrial product.

NATIONAL

NATIONAL TWIST DRILL & TOOL — ROCHESTER, MICH. U.S.A.

TWIST DRILLS
REAMERS, HOBS
MILLING CUTTERS
COUNTERBORES
SPECIAL TOOLS
END MILLS

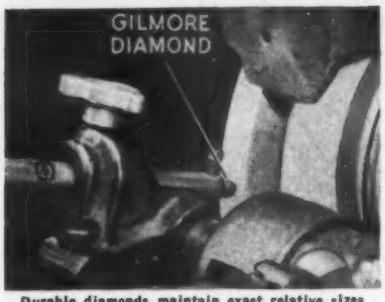
TWIST DRILL AND TOOL COMPANY

ROCHESTER, MICH., U.S.A.

Tap and Die Division — Winter Bros. Co.

Factory Branches • New York • Chicago • Detroit • Cleveland • San Francisco • Distributors in Principal Cities

GILMORE DIAMOND TOOLS *for Wheel Truing, Turning & Boring*



Durable diamonds maintain exact relative sizes on piece being ground on a double-wheel operation.

A six-cornered diamond maintains a radius within close limits on the face of a formed wheel.

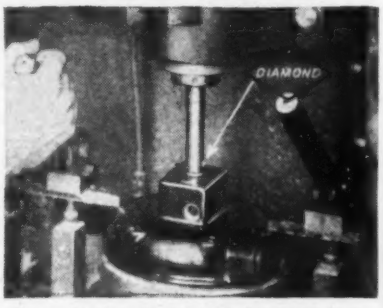
PRODUCTS OF PIONEERS FOR TODAY'S NEEDS

Full advantage is taken by Gilmore of the inherent characteristics of the diamond in the highly specialized tools which bear the Gilmore Trade Mark.

Many years of engineering research, modern plant facilities and the actual experience of the many users of Gilmore Tools have contributed to the outstanding position of Gilmore in this field.

You are invited to call on our engineering staff for any information pertaining to the use of Diamond Tools for Grinding Wheel Truing, Turning, Boring or other industrial applications of diamonds.

Diamond Boring Tool performing a precision boring operation on wrist pin hole of piston.

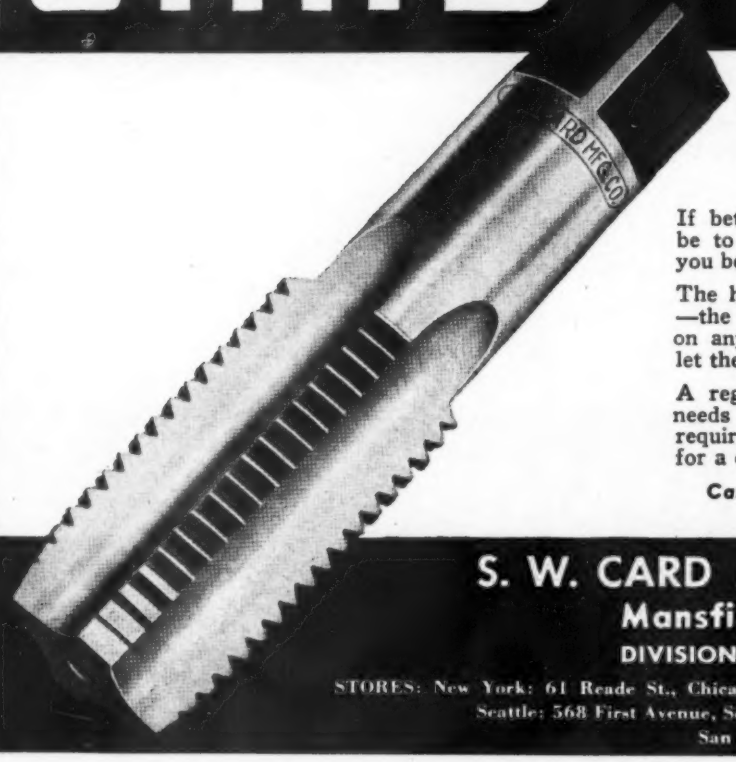


Bronze bearings in motor housing bored to a "plate glass" surface with diamonds.

Send for: Catalog #45 . . . a 32-page manual on Diamond tools for Grinding Wheel Truing. Catalog #46 . . . containing 36 pages of data and illustrations on Diamonds for Turning, Boring, Testing, Gage Contacts, Engraving Tools, Abrasive Tools and Diamond Styli.

F. F. GILMORE & CO.
285 COLUMBUS AVE., BOSTON 16, MASS.

CARD TAPS



ARE YOU INTERESTED IN BETTER TAPPING?

If better production tapping is your objective, it will be to your advantage to come to Card. We can help you because we sell better tapping performance.

The high quality of work done—the quantity produced—the economy of using Card Taps—will be apparent on any tapping job. Just put Card Taps to work and let them prove their superiority.

A regular catalog tap in most cases will meet your needs without using special taps. You'll find your requirements covered in the Card Catalog No. 34. Write for a copy.

Card taps are sold by leading dealers everywhere

S. W. CARD MANUFACTURING CO.
Mansfield, Mass., U. S. A.
DIVISION OF UNION TWIST DRILL CO.

STORES: New York: 61 Reade St., Chicago: 11 South Clinton St. Detroit: 5527 Woodward Ave.
Seattle: 568 First Avenue, South Los Angeles: 168 South Central Avenue
San Francisco: 121 Second St.

Immediate Delivery

HIGH SPEED STEEL, STRAIGHT SHANK

TWIST DRILLS

EXTRA LENGTH

9" CUTTING FLUTES—12" LONG DRILLS

SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET	SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET
1/8"	12	9	$1.50	21/64"	12	9	$2.25
9/64"	12	9	1.50	11/32"	12	9	2.25
5/32"	12	9	1.50	23/64"	12	9	2.50
11/64"	12	9	1.50	3/8"	12	9	2.50
3/16"	12	9	1.50	25/64"	12	9	2.75
13/64"	12	9	1.60	13/32"	12	9	2.75
7/32"	12	9	1.60	27/64"	12	9	3.00
15/64"	12	9	1.75	7/16"	12	9	3.00
1/4"	12	9	1.75	29/64"	12	9	3.25
17/64"	12	9	1.85	15/32"	12	9	3.25
9/32"	12	9	1.85	31/64"	12	9	3.25
19/64"	12	9	2.00	1/2"	12	9	3.25
5/16"	12	9	2.00				

HIGH SPEED STEEL, TAPER SHANK

TWIST DRILLS

EXTRA LENGTH

SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET	SIZE INCHES	LENGTH OVERALL INCHES	LENGTH FLUTES INCHES	PRICE EACH NET
17/32"	15	12	$6.50	27/32"	15	12	$11.50
9/16"	15	12	7.00	7/8"	15	12	12.00
19/32"	15	12	7.50	29/32"	15	12	12.50
5/8"	15	12	8.00	15/16"	15	12	13.00
21/32"	15	12	8.00	31/32"	15	12	14.00
11/16"	15	12	8.25	1"	20	15	16.00
23/32"	15	12	8.50	1-1/16"	20	15	17.00
3/4"	15	12	8.50	1 1/8"	20	15	18.00
25/32"	15	12	9.50	1-3/16"	20	15	20.00
13/16"	15	12	11.00	1 1/4"	20	15	22.00

Victor Machinery Exchange

INC.

251 CENTRE STREET — **NEW YORK 13, N. Y.**

PHONE: CAnal 6-5575

GOVERNMENT-OWNED SURPLUS

CUTTING OILS
at BARGAIN PRICES

APPROXIMATELY 685,284 GALLONS

Priced at 20¢ to 30¢ per gallon

Machine tool shops everywhere can now secure high grade cutting oils at these low prices. These oils were manufactured under exacting government specifications and include alkaline soap solutions, soluble oils, straight mineral oils, mineral lard oils, and chlorinated and sulphurized base oils blended with mineral oils.

They are available immediately and are for sale by the following Regional War Assets Administration Offices:

LOCATION	GALLONS	LOCATION	GALLONS
Atlanta	17,049	Louisville	517
Birmingham	41,436	Minneapolis	67,137
Boston	18,111	Nashville	902
Charlotte	230	New York	83,899
Chicago	84,200	Tulsa	2,399
Cleveland	47,048	Omaha	3,498
Dallas	12,433	Philadelphia	75,684
Denver	29,292	Richmond	12,084
Detroit	85,045	St. Louis	17,658
Houston	2,922	Salt Lake City	3,399
Jacksonville	1,134	San Antonio	3,580
Kansas City	55,202	San Francisco	2,957
Little Rock	55	Seattle	5,333
Los Angeles	14,650	Spokane	447

These prices are f.o.b. point of shipment and apply to all levels of trade. All sales are subject to standard WAA terms and conditions of sale. Minimum quantity five drums (55 gallons each) except where specific items may be packed in smaller containers in which case minimum purchase shall be 200 gallons.

Offers to purchase the above material will be accepted until noon November 30, 1946 by any Regional Office having an inventory at which time orders will be filled in the following sequence as provided by law:—

1. **Certified Veterans of World War II;**
2. **Subsequent priority claimants;**
3. **Non-priority purchasers.**

Federal agencies have had opportunities to fulfill their needs. VETERANS OF WORLD WAR II should apply to their nearest WAA Regional Office for certification; the case number assigned and the location of the certifying office must be stated in a veteran's offer to purchase.

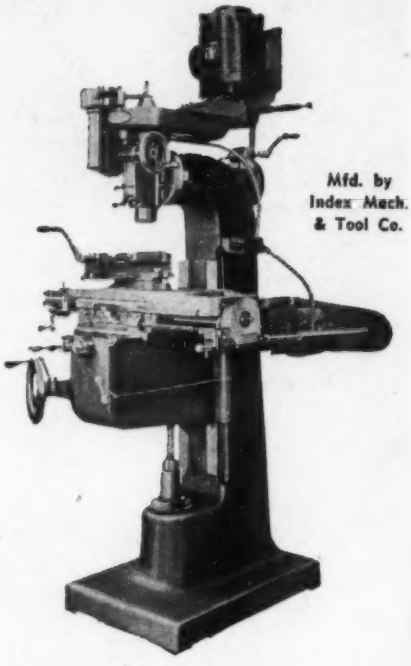
Address your purchase offer to the Regional Office nearest you having the inventory

WAR ASSETS ADMINISTRATION

760

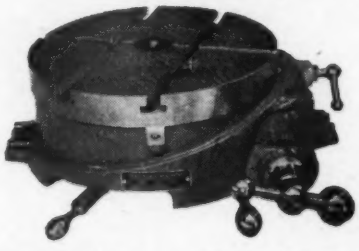
INDEX MILLS

will help you on your tool, die and production work. In addition to micrometer dials on screws, verniers are standard equipment for cross and longitudinal locating. If finer precision is desired, rods and indicators are available. These in conjunction with power feed to a precision ball bearing spindle make a very versatile machine for milling, drilling and boring. ***Literature promptly mailed on request.***



Mfd. by Index Mach. & Tool Co.

12" Tool Room Rotary Table



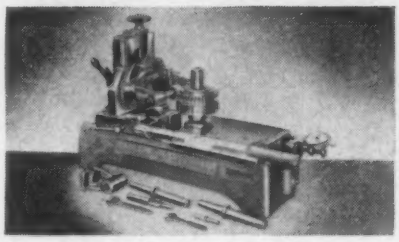
A quality tool for precision work in the tool room or production line, incorporating such features as ball bearings—hardened and ground worm—quick acting throw-out for free hand turning—single movement table lock that does not cramp table out of alignment—compound trough. 12" size only.

For use on Index Mills or any other machine that will accommodate a 12" table.

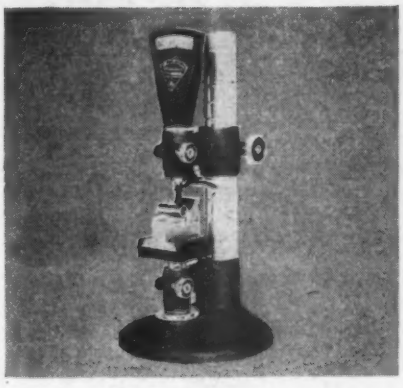
BLANK and BUXTON MACHINERY

3100 E. MICHIGAN AVE.
JACKSON, MICH.

SCHERR MICROMETERS

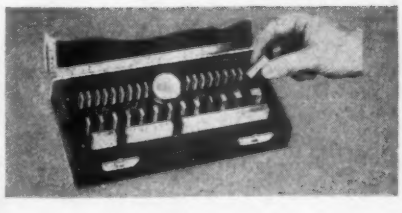


PARKSON GEAR TESTER
Discloses all gear errors with gear in mesh. Can provide a permanent record of each gear for future reference. For spur, bevel, internal, spiral, worm gears. Ten sizes—1/4" to 36". Single purpose and universal models.

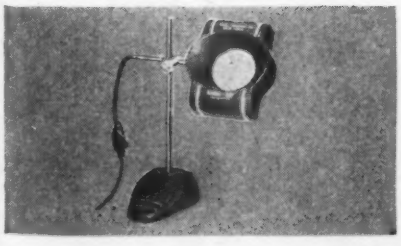


SCHERR COMPARITOL
Gives visual, magnified readings to 1/10,000". Checks gage blocks, plugs, other tools for wear. Rapidly checks volume production of small parts without dependence on skill or "feel" of operator.

WILDER MICRO PROJECTOR
Throws magnified shadow image of work for comparison with master drawing. Most accurate way to check small parts, threads, gears, odd forms. Ideal for checking tool wear on screw machines by periodical inspection of work.



ULTRA CHEX GAGE BLOCKS
Accurate within .000008". A sound basis for building the accuracy standards of the entire shop. Large and small sets, to meet all requirements.



SCHERR MAGNI-RAY
Magnifies work under inspection and floodlights it with rays shielded from operator. Three models widely used for inspection.

measure to "tenths" with no addition to price

Now you can get Scherr Micrometers (made for 30 years under the name Reed) with accurately inscribed vernier which gives you readings to .0001". There is no extra charge for this feature.

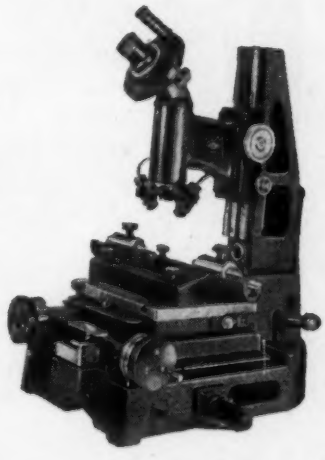
"Tenths" are here to stay. And Scherr makes the tool to measure them—with a long-lived, smoothly operating, sensitive micrometer screw formed by a burnishing process that "densifies" the metal of the threads, eliminates all possibility of rough spots, and gives that velvety "feel" that mechanics value.

Scherr Micrometers have the "tenths" vernier in 1", 2" and 3" sizes. 4", 5" and 6" sizes read to thousandths. Now ready for immediate shipment. With metric as well as inch calibrations. The new catalog gives full data on various types.

WRITE FOR NEW CATALOG ON SMALL TOOLS with details and price sheet on Scherr Micrometers. Also for bulletins on other Scherr equipment shown on this page. WHEN IN NEW YORK visit our showroom and see these tools in action.

GAERTNER TOOLMAKERS' MICROSCOPE

For rapid precision checking of critical dimensions, angles, contours, etc. A scientific laboratory instrument with the rugged strength of a manufacturing tool. Valuable in both tool room and inspection department.

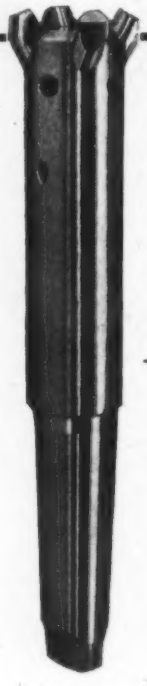


GEO. SCHERR CO., Inc. 201 LAFAYETTE STREET NEW YORK 12, N. Y.

YOU'LL GET MASS PRODUCTION WITH STATE FOUR-CUTTERS

A glance at the Four-Cutter shows that it's built for fast, accurate boring. Take the tough job of core drilling, for instance. The bits of the Four-Cutter counterbalance each other; so the bar doesn't spring away from the work. Furthermore, the chips have plenty of clearance; no binding and choking.

After a lot of punishment, the bits naturally become dull. But the Four-Cutter bits are easy to dress. Just loosen the setscrews, run out the bits with the follow screws, and you have material for new cutting edges.



FIFTY STANDARD SIZES

Four-Cutter Boring Bars with plain bodies are made in 20 sizes . . . Four-Cutter Core Drills with fluted bodies are made in 30 sizes . . . ranging from ¾" to 4¾" minimum cutting diameters. Extension of the bits provides greater cutting diameters—⅛" increase in the smallest size; 1¼" in the largest.

Special models are built to order—with two or more clusters of bits; with wear strips, pilots, collars, facing bits, oil holes, etc.

Mail coupon or write for particulars. Also indicate if you desire information on DIALSET Tools and VELSEY Surface Plates.

EAST SHORE MACHINE PRODUCTS CO.
State Tools Div., Dept. 1, 835 E. 140th St., Cleveland 10, Ohio

Send information on FOUR-CUTTER Drills; also on ☐ DIALSET Boring Tools and ☐ VELSEY Black Granite Surface Plates.

INDIVIDUAL

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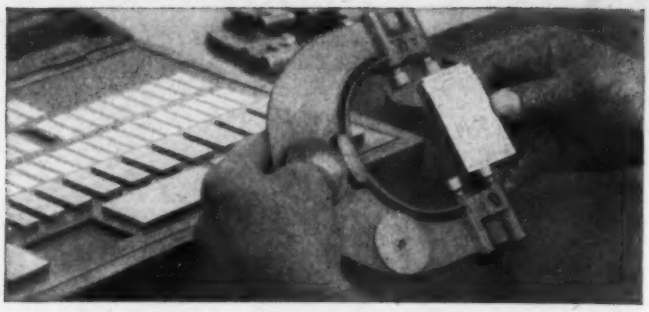
STREET ADDRESS

CITY, ZONE, STATE



Tolerances Worth Maintaining Are Worth Jo-Block Protection

When you set up dimensional inspection tolerances, it's to insure a specified class of fit in assembly, or to make sure of parts-interchangeability, or for some other good reason. The harder it is for an inspector to be *sure* he's staying within limits, *the more it costs.*

So, why not put a set of Ford Jo-Blocks on guard? Make it part of somebody's routine to check every working gage—whether snap-gage, micrometer caliper, dial indicator, plug-gage, ring-gage, or any other dimensional test device—with genuine Ford Jo-Blocks at definite, frequent intervals. Then, you'll *know* that everybody concerned is "speaking the same language" of measurement. Chances are, inspection will speed up and rejections will be fewer.

Jo-Blocks are not expensive. They're made to three warranted accuracy standards—plus or minus .000002", .000004" and .000008". Sold throughout the Americas as single blocks or in varied sets (metric measurement, too). Extremely useful accessories available to expand and facilitate use of Jo-Blocks.

FREE—NEW CATALOG

Write for catalog No. 17, containing illustrated applications of dozens of Jo-Block uses. Address: Ford Motor Company, Johansson Division, Dearborn, Michigan, Department 111.

Johansson GAGE BLOCKS

ERRINGTON MECHANICAL LABORATORY

TAPPING CHUCKS

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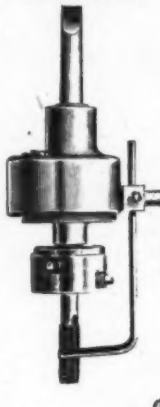
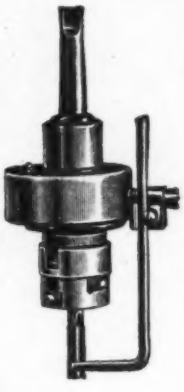
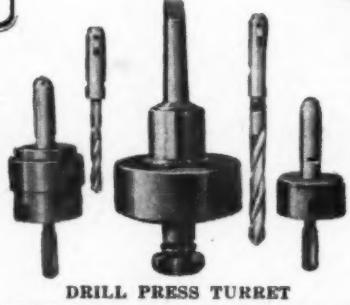


Size			Taps Exact Size		
No.	00	H.S.	Up	to	¼"
"		00	⅛"		7/16"
"		0	7/16"		⅓"
"		1	9/16"		¾"
"		2	⅞"	1	"
"		3	5/8"	1¼	"
"		4	¾"	1½	"
"		5	¾"	2	"

Our High Speed Tappers are Super-Sensitive for Small Tapping



Style B Positive Stop Holds Work Down



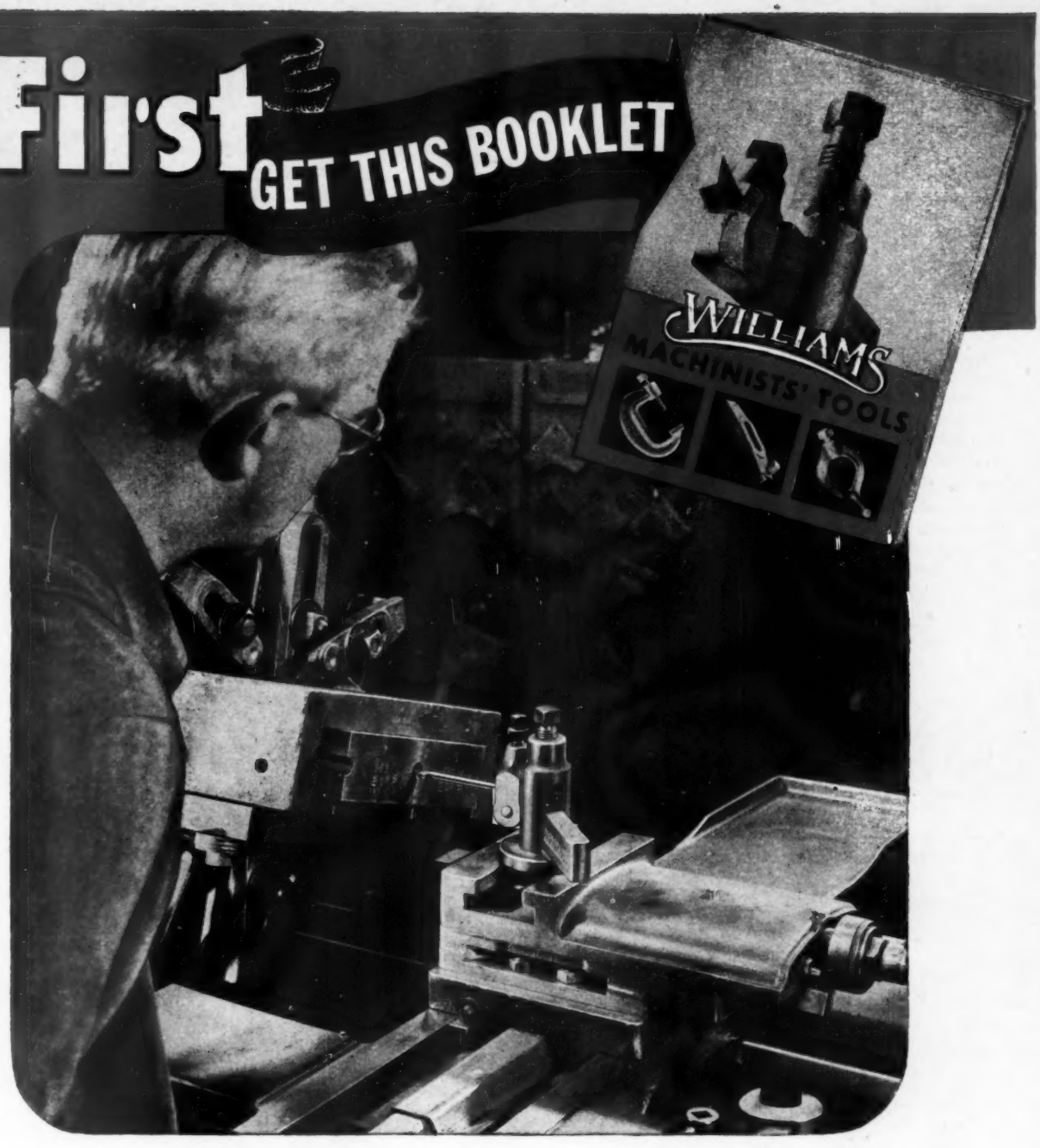
Style C Graduated Adjustable Safety Friction

DRILL PRESS TURRET

Style D-E with Quick-Change Tool Holders to Drill, Tap and Set studs, etc., without moving work, or stopping or reversing machine. Individual friction adjustment in each tap-holder. If required.

Also, Opening Die-Heads; Opening Stud-Setters; Friction Screw-Drivers and Nut-Setters, etc.

First GET THIS BOOKLET



Good Tools are the first step in reducing shop and tool-room costs. This 36-page booklet illustrates and describes Williams postwar line of quality Machinists' Tools. Ask for your copy. Williams Tools are sold by leading Industrial Distributors everywhere.

J. H. WILLIAMS & CO., BUFFALO 7, NEW YORK

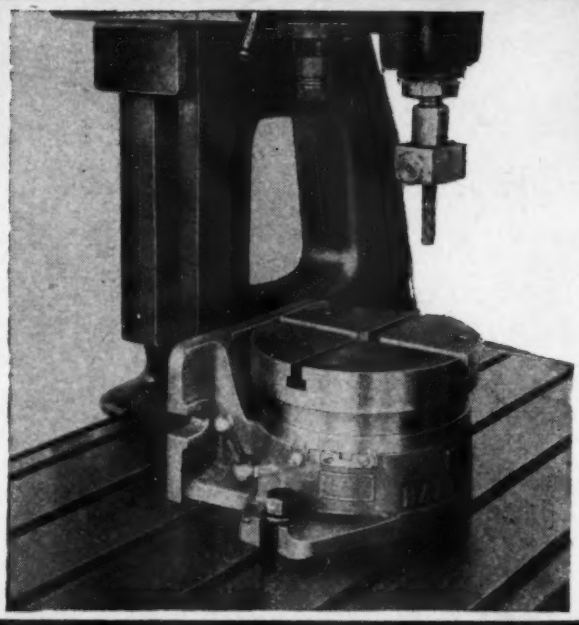
Williams Light, Boring-Tool Holder. A handy and economical tool for light boring, internal threading and turning.

WILLIAMS
DROP-FORGINGS AND DROP-FORGED TOOLS

IN THE TOOL ROOM OR ON THE PRODUCTION LINE

THE HARTFORD SUPER-SPACER

provides precision, speed and convenience in indexing



Here we see the Super-Spacer equipped with a face plate for very precise location of work in jig boring. This use of the Super-Spacer suggests a means of handling indexing which should be highly useful in many tool rooms. Inasmuch as the Hartford Super-Spacer is a device of such high precision as to recommend its use in jig boring, it is readily apparent that its accuracy is such as to meet all requirements of other operations such as boring, grinding, planing, slotting, etc.

All these applications are available in a spacing device which is simple and foolproof and one requiring no special skill to handle. There are therefore many jobs that can be done faster and with greater accuracy with the Super-Spacer.

It will be to your advantage to study the possibilities in your shop where indexing is involved and determine where the Hartford Super-Spacer can be used. Our engineers will be glad to assist you in your study in every way possible. Just outline your requirements and ask for our recommendations.

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THE HARTFORD SPECIAL MACHINERY COMPANY

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ALMOND THREE-JAW DRILL CHUCKS—the first to be placed on the market more than seventy years ago—pioneered the ALMOND CHUCKS have field of drill chucks. During all these many years, continued to be a necessary part in the logical procedure of machine developments.

Made in types and sizes to fit all machine tools and portable drills.

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Do you have to hold small assemblies for drilling or welding? Are you required to hold work at odd angles? Is clamping space limited? Must you exert great pressure to hold parts?

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Knu-Vise, through many years, has learned the most efficient way to coordinate clamping operations with production requirements; and this background of experience can be made valuable to you.

Knu-Vise toggle-action clamping devices (only a few shown here) are recognized for their bull-dog grip and quick release, and their capability of simplifying and increasing production.

Ask us for any help you need in clamping operations. In the meantime, would you like a catalog?

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No matter what *your* protective packaging problem involves—electric fans, appliances, machine tools, precision instruments, small parts or huge machines—it will be to your advantage to find out what Cocoon can do for you. Submit your problem to us for analysis. R. M. Hollingshead Corporation, *Coatings Division*, Camden, N. J.; Toronto, Canada.

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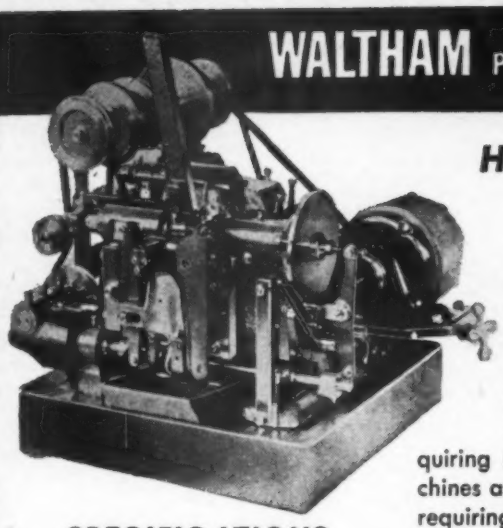
LEADER IN MAINTENANCE CHEMICALS

Whiz

Applied with spray gun Strips off like banana peel

WALTHAM PINION & GEAR CUTTING MACHINES



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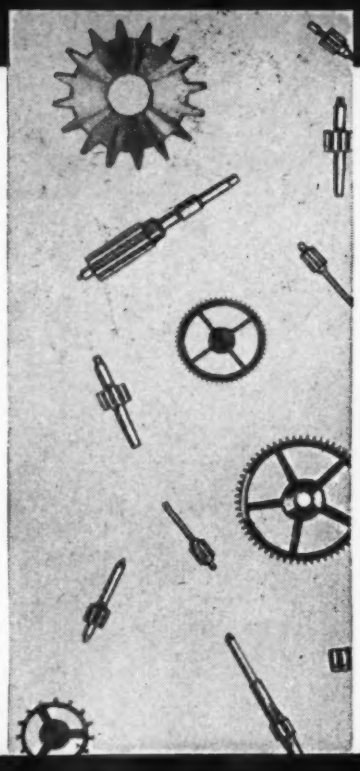
These machines—made in single-cut, multiple-cut and magazine-feed types—are designed for the fast, precision production of gears and pinions for watches, instruments, fuses, etc. They are simple to operate, requiring no special skill. Magazine-feed machines are fully automatic, the other machines requiring positioning of blank and starting by hand.

Drive for these machines is either from countershaft or by individual motor. On motor driven machines, V-belts drive cutter spindle, worm shaft and pump.

Illustrated literature and detailed specifications are available promptly on request.



SPECIFICATIONS

PINION MACHINES

Diameter capacity, approx. ½"
Coarsest pitch about 32 D.P.
Strokes of Work slide for pinions—.24" to .45"
Strokes of work slide for stacked gears —.85 to 1"

GEAR MACHINES

Pitch diameter, capacity 1½"
Strokes for work slide, .40", .65", 1.00", 1.25"

WALTHAM MACHINE WORKS
WALTHAM, MASS.

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TRADE MARK REGISTERED U.S. PAT. OFF.

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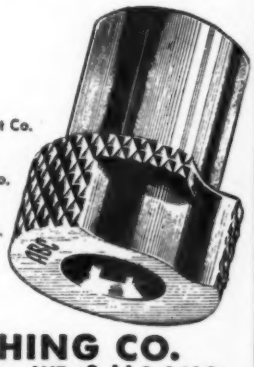

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SOLID CARBIDE REPLACEABLE BITS

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You cut costs . . . you increase efficiency when you use Super Ejector-Type Tools for Carbide machining applications. Tests prove heat concentration is reduced—thermal checking almost totally eliminated. This means extra long life and higher production after sharpening . . . frequently permits using harder-than-ordinary grades of Carbide, with correspondingly higher cutting efficiency.

For better chip flow—smoother cuts, the bit-holding mechanism is inside . . . where it can't interfere with chips or assembly of tool in tool block. Well-supported replaceable Carbide bits are extra long and extra sturdy and take deep cuts with safety. Since the bit is mechanically held, there are no destructive brazing strains to weaken the tip.

Tool cost is sharply reduced! Compound-angles of the ejector mechanism permit feather-light regrinding cuts on top, end, and side and produce sharp, new cutting edge with minimum loss of Carbide. This versatile tool machines *any* machineable material. Replaceable Carbide bits are furnished in proper grade for each job. See your dealer or write for further information.

*PATENTS PENDING

See this tool demonstrated at space No. A-129, National Metal Exposition, Atlantic City, New Jersey, November 18 to 22.

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Cut Costs
MAYBE YOU HAVE
SIMILAR
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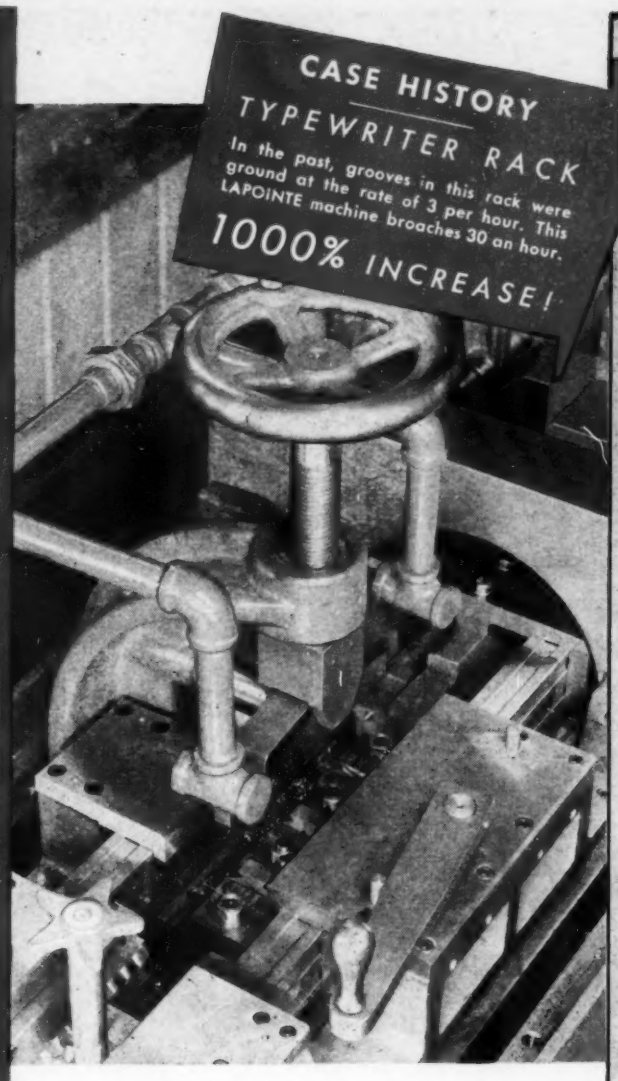
4. Tool Bit Holder
5. Plier Jaws


CASE HISTORY
TYPEWRITER RACK
In the past, grooves in this rack were ground at the rate of 3 per hour. This LAPOINTE machine broaches 30 an hour.
1000% INCREASE!

BROACHING gives you increased Production, Precision, Lower Cost.

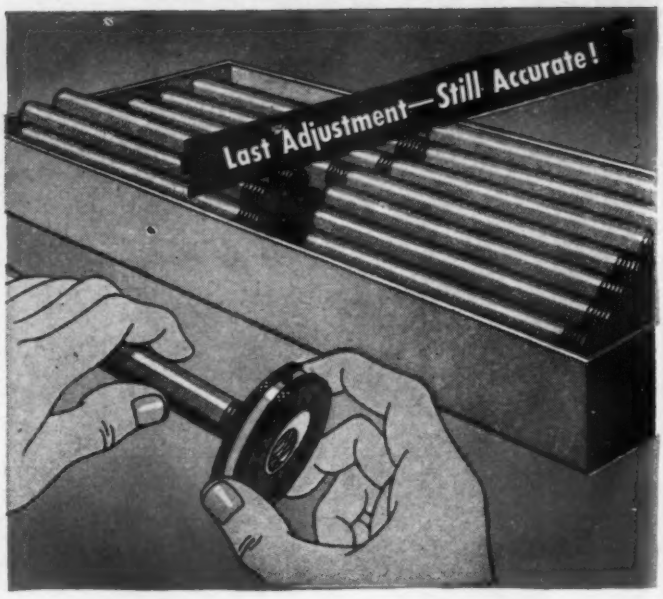
Where continuous contour is desired, through or over any piece of metal, broaching generally is the most efficient method of cutting. This is particularly true when large volume, exact tolerances, time and costs are important. Let LAPOINTE engineers show how broaching can help you cut costs.

THE *Lapointe*

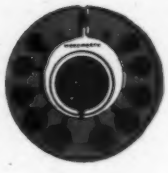
MACHINE TOOL COMPANY

HUDSON, MASSACHUSETTS, U. S. A.

OLDEST AND LARGEST MAKERS OF
BROACHES AND BROACHING MACHINES



Amazing Adjustable Thread Ring Gage

Starts round *stays round* 

5-PLUS FEATURES

1. Accurate and stable
2. Long wear life
3. Light weight
4. Positive identification
5. Positive adjustment

ACCURACY YOU CAN TRUST

A NEW WAY to cut inspection costs—shift to the New Woodworth Adjustable Thread Ring Gage.

The design of this gage gives you long life accuracy, never before possible with conventional thread ring gages. Because of the accuracy, gage life is increased many times. One large plant is getting 12½ times longer service than with the old style gages.

Think what this will mean to your inspection costs.

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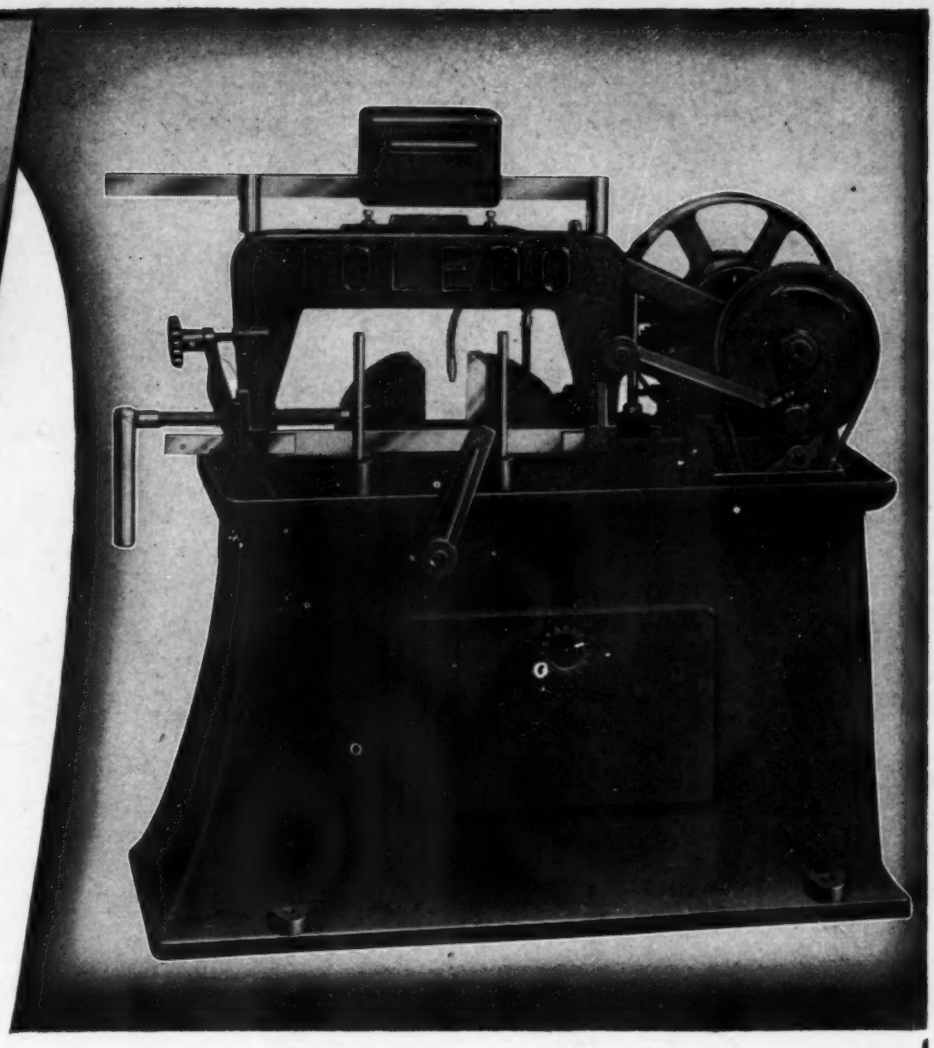
N. A. WOODWORTH CO., SALES DIVISION, 1300 E. NINE MILE ROAD • DETROIT 20, MICHIGAN

PRECISION GAGES • PRECISION MACHINED PARTS • DIAPHRAGM CHUCKS • ADJUSTABLE CLAMPING JIGS • SPECIAL TOOLS

L-W

NEW MODEL
HIGH SPEED

POWER HACK SAWS



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BELT DRIVE
RIGID FRAME
GRAVITY FEED
LENGTH GAUGE
EXPANDING CLUTCH
DOVETAILED SAW FRAME GUIDE
SWIVEL VISE

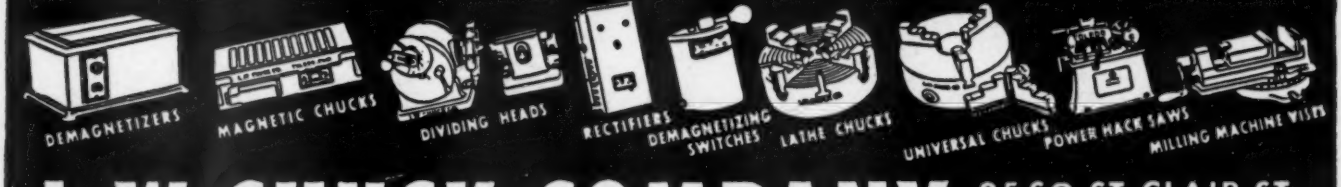
ONLY

$225.15

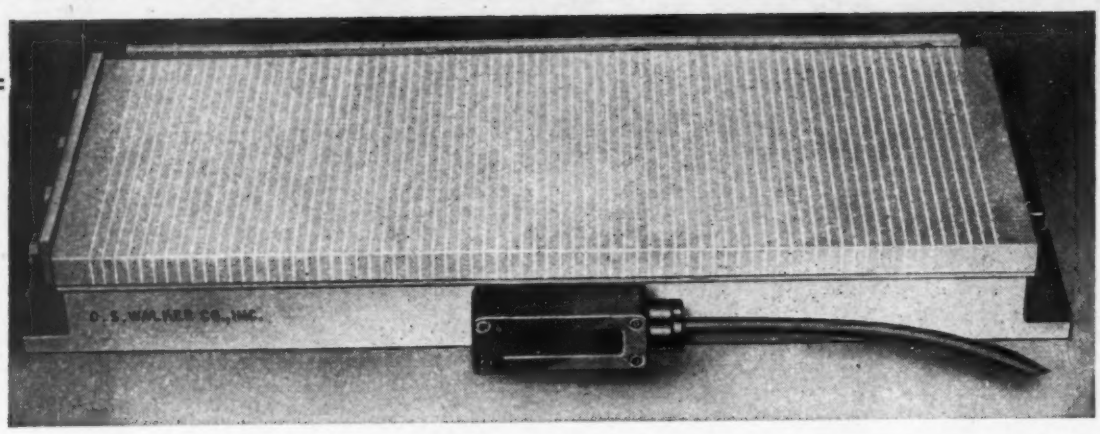
● Automatic trip stops machine on completion of cut . . . automatic relief of saw blade on non-cutting stroke. 6" x 6" capacity using 10" to 14" blades. Clutch pulley 12" x 3". Pulley speed 120 R.P.M. Sliding bearing is dovetailed to fit arm and is adjustable in all directions. Swivel vise permits cutting at various angles. Coolant pump mounted inside the base.

3-speed V-belt Motor Drive arrangement which assures maximum power transmission efficiency and permits speed adjustments from 90 R.P.M. to 130 R.P.M. also available at $25.90, less motor. ½ H.P. standard speed, 1725 R.P.M. motor recommended.

Send for complete catalog giving prices and specifications on these quality, low-cost L-W Products



L-W CHUCK COMPANY 25 SO. ST. CLAIR ST. TOLEDO 4, OHIO



The above illustration portrays one of the many *Walker* basic designs.

Defying duplication of its magnetic characteristics and designs, it has withstood the test of years of service.

The use of *Walker Chucks* insures increased production and low labor costs.

These Chucks are available in all sizes.

Walker's has a Chuck for every known application.

Walker engineers invite you to submit your problems at no obligation to yourself.

Walker Chucks

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ORIGINAL DESIGNERS AND BUILDERS OF MAGNETIC CHUCKS

MAGNETIC CHUCKS • GRINDING MACHINES

Just ONE setting per form
Just ONE continuous motion

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FEATURES:

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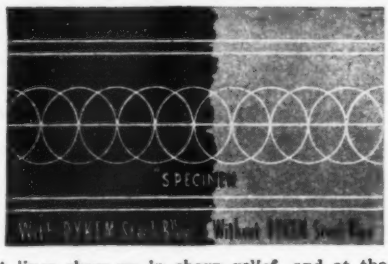
STOPS LOSSES

making dies & templates



simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

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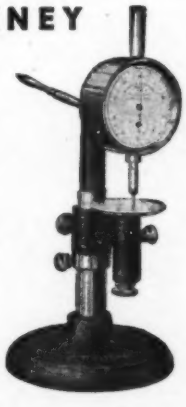
Universal Gauge

for rigid inspection of a wide range of parts . . .

An almost unlimited use is offered by this instrument for inspecting duplicate parts in quantity or any small parts with flat surfaces or recesses.

Use of standard blocks made possible by raising or lowering table increases capacity to take material up to 2" in height. Graduated to read to .001 inch: height 9¾"; weight 5 lbs. 1¼ oz.; depth from frame to spindle 1⅝".



Full details on request

Can be supplied with sliding head and table: also on a stand with throat 3" deep.

FRANK E. RANDALL CO.

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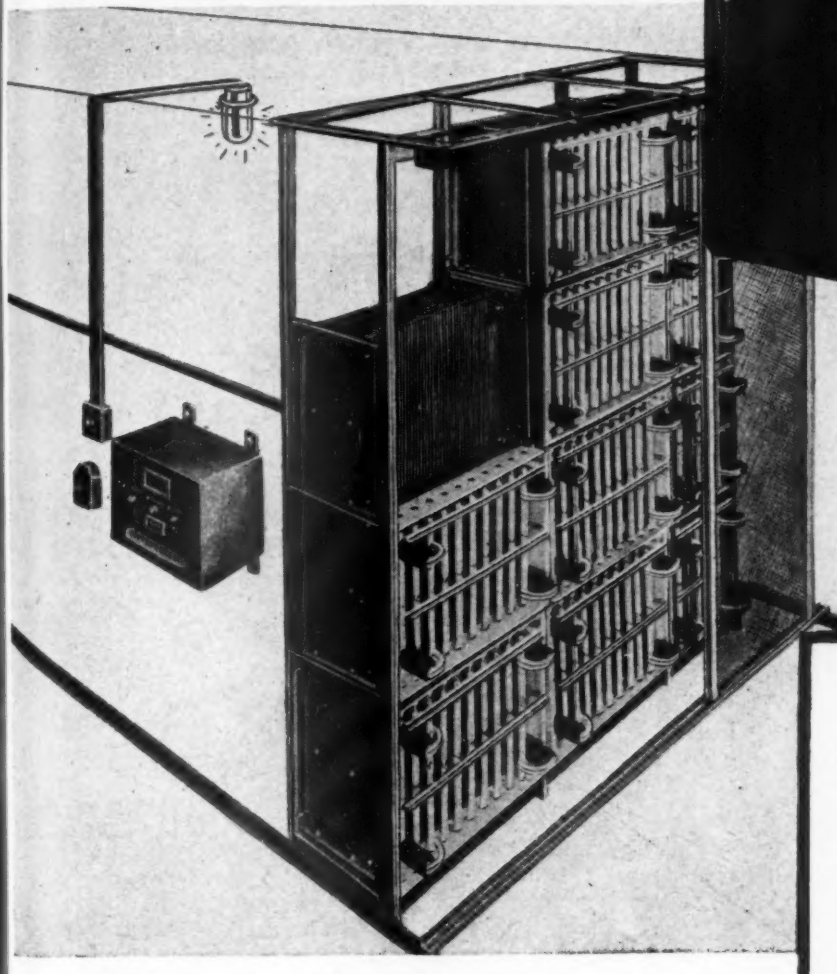
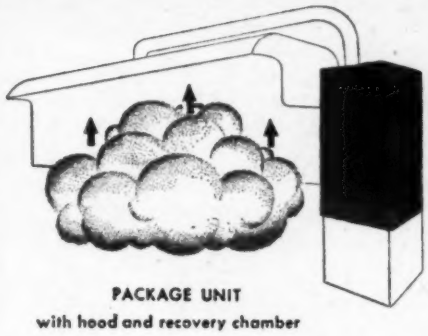


COMPLETE PACKAGE UNITS can be put right to work in smaller areas. Available in several sizes, with capacities of 200 to 2250 c.f.m.

FOR LARGE AREAS or installation in existing duct systems, the cell-unit type Precipitator can be built up to provide any required capacity.

FOR RECOVERY OF CUTTING OILS and compounds, and other fluids and solids, Raytheon Package Type Precipitators can be furnished with recovery chamber, and readily adapted for use with any type hood.



PACKAGE UNIT
with hood and recovery chamber

Before you invest in air cleaning equipment, consider the extra advantages offered by RAYTHEON.

Built in any capacity from 200 c.f.m. up, RAYTHEON Precipitators supply electronically-cleaned air for any area regardless of size. These new, high-efficiency units remove virtually all airborne dust, smoke, pollens, oil mist, etc. down to particles as fine as 1/250,000 of an inch.*

Wherever clean air pays dividends . . . as in precision grinding, machining, measuring, testing . . . there's a RAYTHEON Precipitator of the exact size and type to fit your needs.

Write today for Bulletin DL-P-503 and 505

*According to Bureau of Standards discoloration tests, the Precipitator is more than four times as efficient as any mechanical filter.

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AND SAVINGS WILL FOLLOW

Vitrified makes it possible to standardize on grinding wheels by offering a wide range of standard types which cover practically all wheels used on standard makes of grinding machines.

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Send for this catalog. Choose a grinding operation in your shop on which you would like to cut costs. Select the Vitrified wheel which meets your specifications, try it out, and compare results with the method formerly used—and you, too, will join the long list of progressive manufacturers who have standardized on Vitrified.

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Better grinding fluid means Better Grinding

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CODOL
LIQUID GRINDING COMPOUND
...The best grinding fluid you can use!

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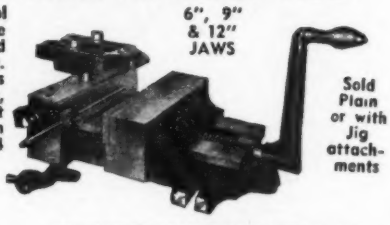
GRAHAM MULTI-PURPOSE VISE

As a plain vise, this tool has flush, parallel, square construction, a great aid to accurate positioning. As a jig or fixture, its numerous stops, guides, special jaws, etc., permit accurate repeat-operation work. Sizes up to 124 lbs.

6", 9" & 12" JAWS



Sold Plain or with Jig attachments

REQUEST NEW BULLETIN 41
completely illustrating and pricing the above Vise and Attachments, also our famous
"ADJUST-ANGLE" KNURL HOLDER FITTING LATHE TURRET

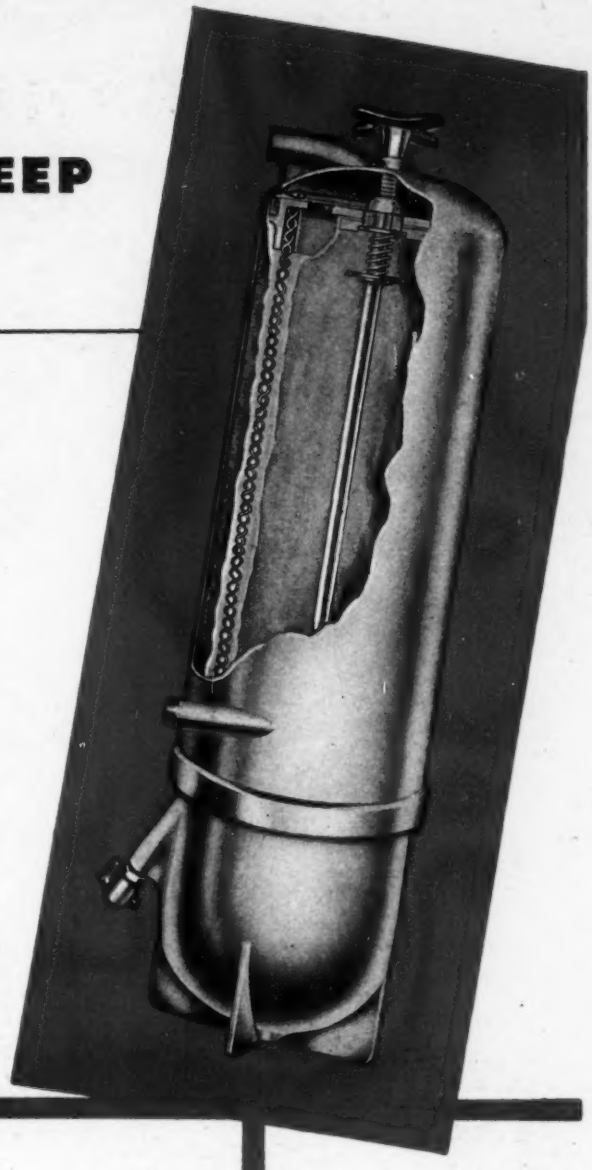
Graham Mfg. Co. 82 BRIDGE STREET EAST GREENWICH, R. I.

DIAMONDS FOR WHEEL DRESSING TOOLS
DIAMONDS FOR THREAD GRINDING TOOLS
DIAMONDS FOR ALL INDUSTRIAL PURPOSES

KOEBEL

Koebel Diamond Tool Co., 9456 Grinnell Ave., Detroit 13

THE *NEW*, EASY, LOW-COST WAY TO KEEP COOLANT *CLEAN*



Now you can put a coolant filter on each grinding machine . . . and gain the advantage of *flexibility* . . . at an average cost of only a few cents a week.

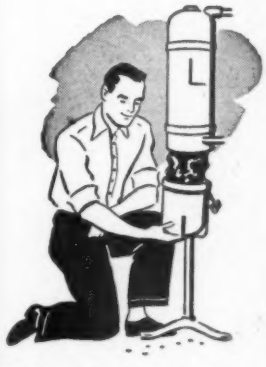
Cuno's new COOLANT-KLEAN is priced less than any comparable filter. The element needs replacement less often . . . new bags are inexpensive . . . coolant stays cleaner longer. Construction is simple and compact.

Typical reports from users say . . . *more dirt collected . . . up to 6 weeks without replacing element . . . "pick-ups" eliminated . . . bags replaced in less than 5 minutes.* (The illustrations show how easy it is to replace the bag.)

COOLANT-KLEAN can be used on any grinder and almost any other machine using coolant or cutting oil . . . is installed quickly, without extra pump, electrical work, plumbing or by-pass. Handles full flow. No filter aid needed. No pre-coating.

Now that unit filtration no longer means high cost, large size and expensive maintenance . . . adopt this more efficient method of cleaning coolant. Send the coupon for COOLANT-KLEAN bulletin.

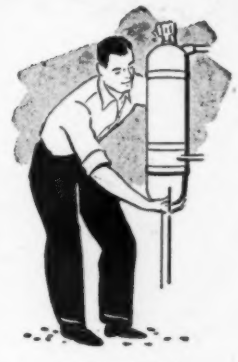
The Easiest Way to Clean a Filter



Single screw clamp at top loosens sump

Grit emptied from sump

New bag easily slipped over spacer screen



Sump replaced

KEEP FLOW ON "GO" WITH

CUNO

ENGINEERED FILTRATION

Free Bulletin on "Finer Finishes at Less Cost"

CUNO ENGINEERING CORPORATION, 244 South Vine St., Meriden, Connecticut

Gentlemen: Send Bulletin on new COOLANT-KLEAN filter to

Name.....

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F-125
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This is the Road YOU Live by . . . .
History's hungriest market for manufactured goods is lined up beside the world's greatest facilities . . . still waiting.
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Federal specializes in upping efficiency through automatic welding, which offers more improvements in metal goods manufacture than any other single method or "tool" we know. Wherever metal fabricating or fastening on a production basis is a problem, resistance welders of one type or another usually provide a profitable solution.
Federal makes every type of resistance welder . . . many specially developed by our welding engineers for highly special needs.
Random examples of every-day production "step-ups" with Federals are illustrated at right. There's a Federal representative in every key city qualified to show you similar methods to speed YOUR goods on the Road to Production.
Production Provides Permanent Personal Prosperity
Look for this Sign at the Metal Show
At Exhibit No. F-125 Federal has a production line in action, teaming Warco Production Presses with Federal Production Welders and making an interesting, marketable product.
THE Federal MACHINE
SUBSIDIARIES
Sommer and Adams Co., Cleveland—SPECIAL HIGH PRECISION MACHINES
The Warren City Mfg. Co., Warren—WARCO PRESSES and PRESS BRAKES

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Tool life greatly increased by reconditioning cutting oil *with*
BARRETT OIL EXTRACTION SYSTEMS

Reports from plants using Barrett Oil Recovery and Reconditioning Systems show surprisingly high percentages in increased tool life. Then, too, users are enthusiastic as to the improved condition of the reclaimed oil as well as the high returns on the investment. Some set-ups in plants engaged on defense production have paid for themselves in a few months.

The Barrett Centrifugal Oil Extractor—which is part of a complete system—recovers 100% of the removable oil or 98½% of the contained oil from chips and turnings in 2 minutes or less. Complete Barrett oil recovery and reconditioning systems include Extraction, Sterilization and Sedimentation, together with filtration. The units involved are available in various sizes, individually or as a group, and are available with full-manual control, semi-automatic control or with full automatic control requiring only loading, unloading, starting and stopping of the extractor by the operator. Complete plans including storage tanks for reclaimed oil or for use in conjunction with existing equipment are also available.

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Barrett Centrifugal Oil Extractor—the heart of Barrett Cutting Oil Recovery and Reconditioning Systems.

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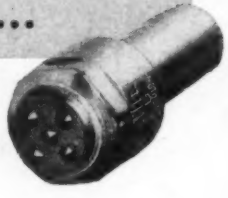
For *speed* and *economy* when roughing or semi-finishing wheels of harder than average bond...



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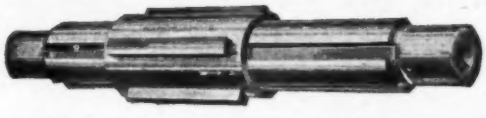
NICHOLSON EXPANDING MANDRELS



These widely used tools cut costs for you 2 ways: by saving the time lost in making or looking for solid arbors; by promoting precision. Set of 19 Nicholson expanding mandrels does the work of 209 solid arbors.
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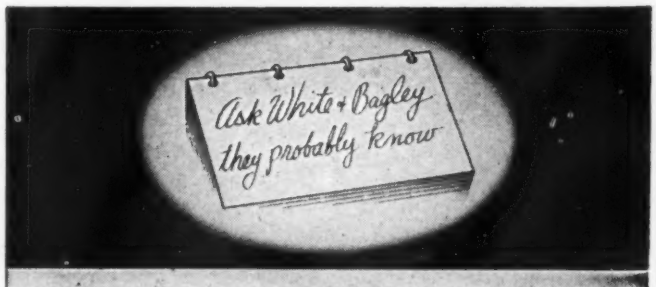
W. H. NICHOLSON & CO., 114 Oregon St., Wilkes-Barre, Pa.



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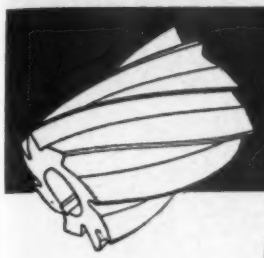

KEEP CUTTERS *Sharp* With the "ACE"

MORE PRODUCTION—MORE ACCURACY—

MORE ECONOMY WITH THE ACE

The "ACE" Cutter Grinder has proven its worth in toolrooms around the world—*Gets More Production*—Cutters stay sharper longer; less down time for changes—*More Economy*—The average life of a cutter is longer, fewer replacements—*More Accuracy*—Cutters sharpened on the "ACE" have all teeth uniformally ground and all Teeth Cutting.

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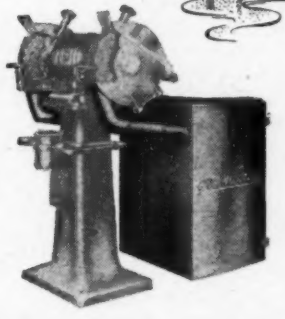
MATERIALS · METHODS · SERVICE · FOR EVERY CLEANING REQUIREMENT



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The AIR MASTER sucks in dust and grit the moment they fly off the whirling wheels of buffers and grinders. They haven't a chance to get into human lungs or sensitive moving parts and bearings of expensive machinery!

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COMPANY

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THE BLAKE FLUTE GRINDER is a new machine designed for one primary purpose: to give you the *maximum obtainable profits* from the use of spiral point taps (also called "gun taps," "chip chasers," "chip drivers," etc.)

It's so very easy and simple to sharpen spiral points on the Blake that even girls are turning out perfect jobs after only a few hours' instruction. And you'll be amazed at the speed of the whole operation —in a few minutes you save several dollars' worth of taps.

Because each Blake-sharpened tap lasts many times longer . . . threads *many more thousands* of accurate holes . . . and allows your tapping machines to be run at optimum speeds by less skilled labor—it won't be long before your Blake Flute Grinder will have paid for itself by reducing your tap bills and greatly lowering the tapping cost per hole.

We invite your investigation of the profit possibilities of this machine in your shop. Send the coupon for complete details.

Please send me a free copy of Bulletin No. 466 which gives complete details on the Blake Flute Grinder. A.M.

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COMPANY_____

STREET_____

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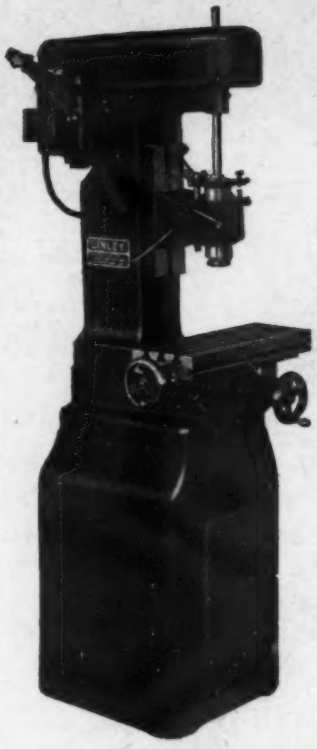
BLAKE TAP GRINDERS—FILTAIRE PORTABLE DUST COLLECTORS—AMERICAN TOOL HOLDERS—BLACK DIAMOND PRECISION DRILL GRINDERS—WALTHAM CUTTER SHARPENERS

TOOLMAKERS



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They know there is not going to be an accumulation of vitally needed jobs on small dies, jigs, fixtures, patterns and models . . . because this compact miller and jig borer turns them out fast . . . fast because setup is easy . . . changeover rapid. It has 8 velvet-smooth spindle speeds to 4250 r.p.m. . . . direct micrometer setting . . . parts balanced for operating efficiency.

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Four Spindle Head. All Spindles Adjustable for equally spaced holes

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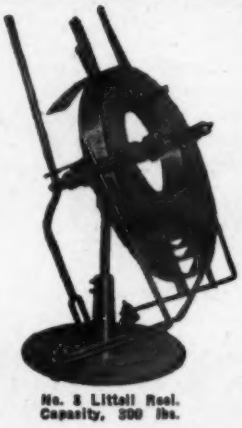

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COIL feeding with LITTELL Automatic Centering Reels increases production, lessens waste, improves quality, loads easier. Littell Reels are made in plain or motor-driven types for handling coils 100 to 20,000 lbs. Littell also makes Roll Feeds, Straighteners, Safety Feeders, etc.

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. . . the tool that converts drilling machines into key-seaters and saves time and money

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Made in twenty-seven different diameters from ½" to 3½". Several widths of cutters can be used in each size.

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Full wave selenium rectification with long life, rugged construction, and free from the effects of shocks Instantaneous operation. No warm-up period required. Wall mounting.

Model	Amps	Volts	Power Source
B-402A	1.5	115	115 Volts A.C.
B-403A	3.0	115	Single Phase
B-404A	5.0	115	50-60 Cycles
B-405A	10.0	115	For All Models

220 and 440 Volts D.C. High Voltage Rectifiers suplied on special order.
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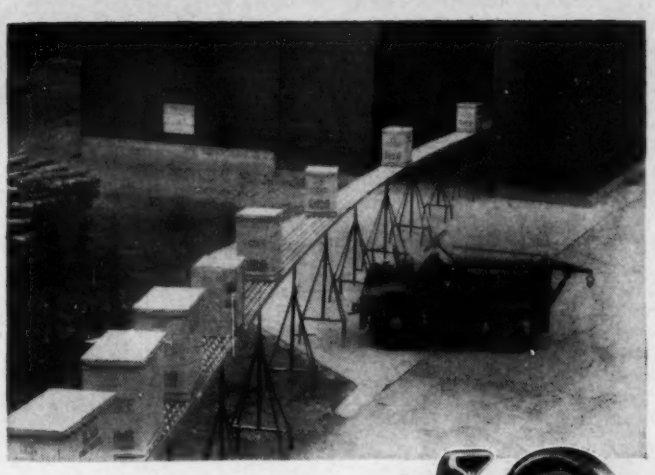

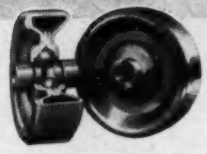

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Exclusive wheel design, specially engineered for Rapid-Wheel gravity conveyors, guarantees longer operating life . . . offers superior performance under severe conditions.

Tests prove that the Rapids-Standard No. 11 recessed-hub conveyor wheels that are grease-packed on assembly are less vulnerable to corrosion, are longer-lived . . . give more efficient service. These tests compared the special Rapids-Standard grease-packed wheels with ordinary wheels that had no lubrication.

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A MODEL FOR EVERY NEED

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12-RS-10	12"	10	550	7.5
12-RS-8	12"	8	500	7.1
12-RS-6	12"	6	450	6.7
18-RS-18	18"	18	750	9.8
18-RS-16	18"	16	700	9.4
18-RS-14	18"	14	650	9.0
18-RS-12	18"	12	600	8.6

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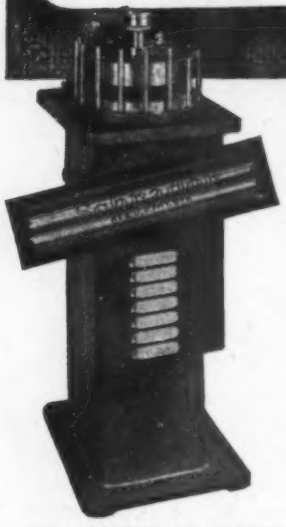

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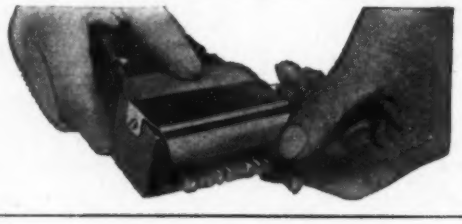

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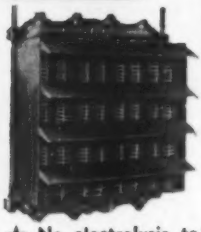
*T. M. Reg. U.S. Pat. Off.

LAST AS LONG AS THE PIPES FURNISHING STEAM TO THEM

HIGH TEST CAST IRON HEATING SECTIONS



★ One piece construction heating sections *(patented)* of high test cast iron that withstand steam pressures up to 250 lbs.

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Sorry, our supply of the 1946 Directory, listing competent photographers all over the country, is exhausted. However, if you will write us, we shall be glad to see that you receive the 1947 issue, which will be available early in the year.

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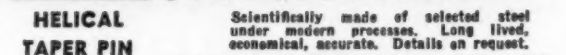

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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WANTED: ASSISTANT Plant Manager, age 35 to 45, with Mechanical and Electrical Engineering background, to assist in the operation of a plant producing steel sheet and strip products. Applicants should give education and experience in detail, and state present and expected salary. Location Eastern Ohio. P-782, American Machinist, 330 W. 42nd St., New York 18, N. Y.

WANTED: ASSISTANT Shop Manager for a plant doing general repair work of heavy construction equipment and building new equipment; must be a combetent machinist and familiar with modern welding techniques and shop practices. Age 35 to 45. Applicants should give education and experience in detail, and state present and expected salary. Location near New York City. P-783, American Machinist, 330 W. 42nd St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS $2,500-$25,000. This thoroughly organized confidential service of thirty-six years' recognized standing and reputation carries on preliminary negotations for supervisory technical and executive positions of the calibre indicated through a procedure individualized to each client's requirements. Retaining fee protected by refund provision. Identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dunn Bldg., Buffalo 2, N. Y.

POSITIONS WANTED

MASTER MECHANIC, 35, married, Member of A.S.M.E. Experienced in various shops, heavy equipment, mining, milling, marine, construction, rehabilitation, preventative maintenance programs. Box 231, McIntyre, Georgia. Jim Tierman.

POSITIONS WANTED

ENGINEERING EXECUTIVE: 45, now heading design and research for nationally known manufacturer of gear cutting machines and allied equipment, wishes to change to a position where engineering and production responsibility will be entirely under his control. Past record demonstrates skill and ability to meet exacting requirements in engineering and management. Salary $12,000. PW-770, American Machinist, 330 W. 42nd St., New York 18, N. Y.

MACHINIST AND Toolmaker, 25 years' experience on small, medium, and large precise work, desires connection with small progressive concern in supervisory capacity. PW-788, American Machinist, 330 W. 42nd St., New York 18, N. Y.

(Continued on page 324)

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EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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10 cents a word minimum charge $2.00.
(See ¶ on Box Numbers.)
POSITIONS WANTED (full or part-time individual salaried employment only), ½ above rates.
PROPOSALS. 50 cents a line an insertion.

INFORMATION
BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.
DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE:
The advertising rate is $8.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. A.M.

NEW ADVERTISEMENTS received by 10 A. M. November 6th will appear in the issue of November 21st subject to limitation of space available

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WANTED

MECHANICAL ENGINEER

With extensive practical experience for a gear manufacturing plant; one whose experience has brought him into contact with cost reduction by means of designing of special tools and fixtures to step-up manufacturing procedures. Must be wide awake with past earnings approximating $10,000. State full particulars including educational background, names and addresses of former employers.

P-767, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

WANTED . . . DEVELOPMENT ENGINEER

By an outstanding Machine Tool company, an extremely capable Development Engineer, who may shortly work into the position of Chief Engineer. No ordinary man should apply for this position. The accepted applicant cannot be more than 45 years of age, and must evidence by his record, extreme capability. Address

P-802, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

PRESSED METAL ENGINEER WANTED

Man with 10 to 15 years design or practical shop experience with pressed metal work to analyze parts now arranged for steel castings or welded structures and redesign for pressed metal where economical. Should have had experience with small as well as heavy work; hydraulic presses, crank presses, bending brakes; blanking, forming and drawing; hot as well as cold. Location Pacific Coast.

P-805, AMERICAN MACHINIST
330 W. 42nd St., New York 18, N. Y.

First Class Mechanic Wanted

To take charge of Metal Furniture Plant. Willing to go South. Must be thoroughly familiar with laying out dies. Write giving experience, salary, etc.

P-763, AMERICAN MACHINIST
330 WEST 42nd STREET, New York 18, N. Y.

POSITIONS WANTED
(Continued from page 323)

WORKS MANAGER or Factory Supt. Age 46. 25 years experience all phases of metal parts and assembly production including: Methods, Design, Tool Engineering, Supervision of Machine Shop, Assembly and Press Room. Willing to locate wherever right opportunity is offered. PW-796, American Machinist, 330 W. 42nd St., New York 18, N. Y.

CHIEF GEAR Engineer with twelve years experience in gear design, gear tooling and production; also diversified tooling and production experience. Location eastern United States. PW-797, American Machinist, 330 W. 42nd St., New York 18, N. Y.

GRADUATE MECHANICAL Engineer: in early thirties, with solid manufacturing background, founded on a four year toolmaker apprenticeship desires position with a small or medium size company. Presently engaged as engineer in charge mechanical design of automatic welding equipment. Current salary, $5,000. PW-798, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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WANTED: representative to sell contract manufacturing for completely equipped West Coast plant specializing in all types of threading, special studs, bolts, nuts, headed and special threaded or unthreaded parts. All types of metals. Kramer & Kramer, 3629 Medford, Los Angeles, Calif.

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REPRESENTATION OR Sales follow-up for out-of-town manufacturers of machinery, small tools and gages, parts, apparatus and equipment in New York City area solicited by an engineering firm capable of providing installation, engineering and specialized personnel necessary. All inquiries welcome. RA-747, American Machinist, 330 W. 42nd St., New York 18, N. Y.

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WANTED

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SW-803, AMERICAN MACHINIST
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Universal Precision Tool Holder, bits, boring bars. Profitable item. *Write*

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Established Business

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Plant layout models made to specifications. Prototypes of any machine available in wood.

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FALK FOR DEPENDABILITY IN REBUILT MACHINERY

AUTOMATICS

1—#00 Brown & Sharpe Full Automatic, Standard Speed
1—1¼" Cone 4-spindle Automatic, Motor Driven, Threading Spindle.
1—#515 National Acme 1⅝" 4-spindle Automatics, complete
2—3¾" Cleveland Model A.
1—#1 Brown & Sharpe Standard Speed, Belt Drive, Full Automatic (same size as #2).
1—#2G Brown & Sharpe Full Automatic, serial #5396.

LATHES

Logan Q.C.G. Lathes (new).
Sebastian Engine Lathes (new).
14" x 20' Hendey Toolmakers Lathe.
16" x 6' American Motor Driven Lathe.
16" x 8' Lodge & Shipley 12-speed Grd. Hd.
18" x 10' American, Geared Head, Taper.
20" x 10' Hendey with Taper.
24" x 20' American, Motor drive.
48" x 30' Simmons Geared Head, 1941.
18" x 6' Chard, M.D.
14" x 6' Rockford Cone drive (two)
13" x 6' Williard, geared head
18" x 222" Hendey, M.D. (two)
20" x 11' Schumacher-Boye, M.D.
14" x 6' Hendey Yoke Head
28" x 10' Davis cone driven

TURRET LATHES

4—#4 Warner & Swasey Hand Screw Machines, arr. Motor Drive.
2—#4 Warner & Swasey Universal Turret Lathe, Motor Driven.
16" Warner & Swasey Brass Lathe.
#2A Warner & Swasey Universal.
#6A Potter & Johnson Automatic Chuckers.
#3R Gisholt Universal like new.
#4 Foster GFH Hand Turret Lathe.
3—Morey #2G Geared Head Turret Lathe, motor drive (late model)
2—Simmons #2 (microspeed) Turret Screw Machine (late model)

TURRET PUNCHES

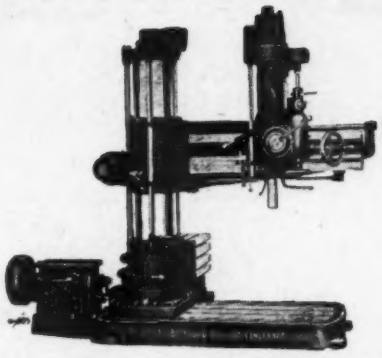
Hecker, vertical type, 8-station, air operated, 18" throat.

PLANERS

20" x 20" x 24" N.B.P., Planer Shaper.
26" x 26" x 8' Gray Planer, 2 heads.

SHEARS & METAL WORKING

Lennox Splitting Shear ¾" cap.; 8' throat.
Lennox Bevel Shear, ¾" cap.
Peckstow 30" x 18 ga. Squaring Shear.
Gould & Eberhardt Slitting Shear, 10 ga.
Niagara 48" Roller Leveller, 6 Rolls.



MILLING MACHINES

#3, #4, #5 Cinn. High Power, Plain, S.P.D.
#1-#1½-#2 Brown & Sharpe Plain Miller.
P & W 2½" Duplex Spline Miller.
Thread Miller, Hall Planetary #1—24".
#8 Lees Bradner Thread Miller.
#1, #2 Kempsmith Plain Millers.
#3B Hendey Universal Miller, motor drive.
Cincinnati-Bickford 5' Arm, 13" round column with air clamp. Oil grooved, tee slotted base, side base, with plain box table with #5 Morse Taper spindle. Motor drive.
#4 Cinn. Vertical High Power Miller. (2).

2—#16 Blanchard Surface Grinder, 30" dia., magnetic chuck, 25 h.p. motor on spindle.
2—#2 Cincinnati Centerless Grinder.
Pratt & Whitney Vertical Surface Grinder, 14" x 36" with 10" x 36" Magnetic Chuck. Ball Bearing Spindle. Perfect Condition.
#2 Cincinnati Universal Tool and Cutter.

RADIAL DRILLS

4' Arm, 11" Column Cincinnati-Bickford.
5' Arm, 13" Column Cincinnati-Bickford.
5' Arm, 14" Column Fosdick, motor drive.
6' Arm, 15" Column Cincinnati-Bickford.
3½', 10" Col., Cincinnati-Bickford AC Motor Drive, Gear Box.

GRINDERS

Queen City Dble. End Grinders, motor driven (new).
#33 Abrasive Vertical Surface.
#3 Abrasive Horizontal Surface.
12" No. 22 Heald Rotary Surface Grinder.
16" Persons-Arter Rotary Surface Grinder.
1—Gardner Dble. Opposed Grinder.
1—Seybold 96" Knife Grinder
Oliver of Adrian Drill Grinders
Cincinnati Centerless Grinders #2 M.D.
#12 Greenfield Internal Hydromatic Grinder, sizematic type, complete with Tank and Pump. 15" swing, 5" hole; 4" deep.
#2 Brown & Sharpe Surface Grinder.
#70 Heald Internal Grinder.
#60 Heald Cylinder Grinder.
10" x 18" Norton Cylindrical.
2—Cincinnati, #1½ Tool & Cutter Grinders.

BORING MILLS

100" Niles-Bement-Pond, 2-hd. geared Mt. Dr.
72" Cincinnati Heavy Pattern Vertical Boring and Turning Mill.
3½" Bar Landis-Rochester Horizontal Boring Mill, Model #36.
#31 Lucas Horizontal Boring Mill, 3" bar.

DRILLING MACHINES

Avey, 2 & 3 spindle Prentice, 4 spindle.
Henry & Wright, 6 spindle, #2 M. T.
Fosdick 13" Super speed 4-spindle drills.
Natco #12, 12 spindle #1 M. T.
2—Natco #14, 22 spindle Rectangular head Drilling Machine, #2 M. T.

POWER PRESS HEADQUARTERS

Famco Arbor & Foot Presses (new).
#4 Bliss D. C. Forging Press.
200 ton A.C.F. Hydraulic Press. Bed. 24" x 36", 4-post.
75 ton H.P.M. 2 post, Hydraulic Press.
Hilles & Jones #4 Single End Punch and Shear. Equipped as Plate Shear with 18" Blades. ARR, motor drive, 54" throat.
1—Leland-Gifford 6-spdle. Drill Press (late model) ind. spdle. motors.

SHAPERS & GEAR CUTTERS

1—Whipp 16" B. G. Crank Shaper.
1—Fellows #6—36" Gear Shaper.
Barber-Colman Gear Hobbers #2, #3.
1—Brown & Sharpe #3—26" Automatic Gear Cutter.
#1 Adams Gear Hobbers, Belt driven (2).
24" American Direct Motor Drive.
Slotter 12" stroke New Haven, motor drive.

MISCELLANEOUS

15 KVA Ace Spot Welder, 18" throat, 1/60/440 volt.

120" x 96" x 24' **Simmons Heavy Duty Double Housing Planer.** Complete with 4 heads and standard equipment, arranged for reversing motor drive and rapid traverse and including one Reliance 50 HP, 150/900 RPM D.C. motor, frame P-4617, 230 volts serial #644739, one Cutler Hammer control Box #B-871007A7.

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No. 35 Excello Thread Grinder, Motor driven, with wheel thinning attachment, refrigerated coolant equipment. New in 1943.

1⅝" Cone Eight Spindle Automatic Screw Machine, with threading spindle, chip conveyor, miscellaneous collets and feed fingers, motor driven. New in 1942.

AUTOMATICS

5¼" Cleveland Model A, single spindle.
16" x 33" Fay Automatic Lathe.
⅞" Cleveland Model M, four spindle.

DRILLS

★ **4 Ft. American Hole Wizard Radial Drill, motor on arm, new in 1940.**
No. D2 Colburn, single spindle.
42" Cincinnati Bickford.
Allen Sensitive Drill, four spindle.
★ **No. 3 Bausch Multiple, 20 Spindle, No. 2 Morse Taper, Rectang. Head 20" x 40".**
Pratt & Whitney Gun Barrel Drill.
LeBlond Gun Barrel Drill.

GEAR CUTTERS

No. 3 and No. 12 Barber Colman Gear Hobbers.
No. 6, 61 Fellows Gear Shaper, m.d.
6" Gleason Str. Bevel Gear Generator.

GRINDERS

36" x 168" Mattison Surface Grinder.
No. 22 Heald Rotary Surface Grinder.
No. 16-26" Blanchard Surface Grinder.
No. 72A3 Heald Sizematic Int. Grinder.
No. 72A3 Heald Gagematic Int. Grinder.
No. 70 and 75 Heald Internal Grinders.
10" x 24" Norton Cylindrical Grinder.
10" x 72" Norton Cylindrical Grinder.
10" x 24" Thompson Hyd. Surface Grind.
No. 2 Cincinnati Centerless Grinder.
★ **No. 3 Cincinnati Centerless Grinder.**

JIG BORING MACHINES

★ **No. 2A Pratt & Whitney, with 22" x 44" Table, 24" rotary table, locating device, inside micrometer, measuring rods, etc. New in 1944.**

LATHES, ENGINE

★ **12" x 30" Monarch Model KK.**
14" x 6' Sebastian, motor in base.
16"x6' Hendey, g.h.
20" x 12' Lodge & Shipley, g.h.
48" x 12' Lodge & Shipley, C.D.
No. 12 Gisholt Hyd. Lathe.
LR Lo-Swing Lathe, m.d., new in 1940.
15" x 30" Lipe Carbo-matic, new in 1943.

LATHES, TURRET

No. 3A Warner & Swasey, g.h.
No. 2A Warner & Swasey, Timken Bearing, new 1942.
No. 1A Warner & Swasey, g.h., new 1943.
No. 1B Foster, g.h.
No. 4 Warner & Swasey, g.h., new in 1942.
No. 3 Warner & Swasey, g.h., new in 1943.
No. 1 Bardons & Oliver, c.d.
No. 1 Brown & Sharpe, m.d.
No. 6D Potter & Johnston Automatic Chucking and Turning Machine.

MILLS

No. 31 Lucas Horizontal Bor'g Mill, m.d.
No. 36 Van Norman Horizontal, m.d.
No. 4A Brown & Sharpe Universal, s.p.d.
No. 3 Cincinnati Universal, s.p.d.
No. 4 Cin. Plain, Rect. Overarm.
No. 2H Milwaukee Plain double overarm, motor in base.
No. 2-MH Cincinnati Plain, m.d.
★ **No. 4H Milwaukee, Double Overarm, motor in base, new 1940.**
No. 2H Milwaukee Vert., motor in base.
18" Cincinnati Plain Mfg.
No. 2209 Milwaukee, Table 22" x 158".
No. 3-36 Cinci. Hydromatic Duplex, m.d.
No. 6 Whitney Hand Mill.
4" Pratt & Whitney Spline Mill.

MISCELLANEOUS

No. 17 Greenerd Arbor Press.
No. 100 Micromatic Hydrohoner.
8" x 7" Troy Vertical Steam Engine.

PLANERS AND SHAPERS

★ **12" Hendey Crank Shaper, motor driven, 16" Ohio Crank Shaper, c.d.**
28" Gould & Eberhardt Crank Shaper.
★ **6" Pratt & Whitney Vertical Shaper.**
42" x 42" x 20' Cin. Planer, D.C. Rev. m.d.

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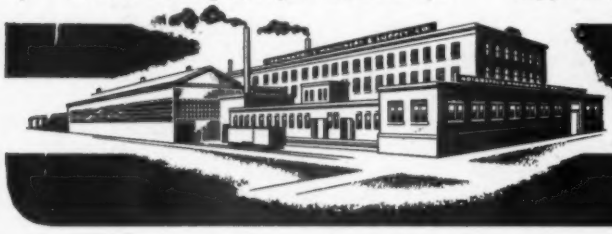

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AUTOMATICS, Gridley, 1¼, 2¼", & 2⅝ Model F, M.D.
AUTOMATICS, Gridley, 2¼, 3¼, & 5¼" M.D.
AUTOMATICS, Cleveland 1¼, 1½, 2, 2½, 3½ & 4¾" Model A, M.D.
AUTOMATICS, Cleveland ⅞, 1¼, & 2" Mod. B
#1 Polymatic Form & Cutoff
#1 Wickman Swiss Type, used very little
CLEVELAND, 3½" Model K-4 M.D.
AUTOMATICS, Potter & Johnston #5a & #6a, M.D.
CONOMATICS, 2⅝—8 spindle, M.D.
GEAR HOBBERS, #3 Barber-Colman, M.D.
GEAR SHAPERS, #6 Fellows, M.D.
GRINDER, Brown & Sharpe #11 Plain, M.D.
GRINDER, Heald #72A Hydraulic, 2 M.D.
GRINDER, Norton 10"x36" Hydraulic, M.D.
GRINDERS, Landis Hydraulic, 6"x18" M.D.
LATHES, Hendey, E.B.M. type, 14"x7' M.D.
LATHES, Hendey 16"x6' M.D.
LATHES, Hendey, 24"x10' G.H. M.D.
LATHES, Rockford, 16"x8' Geared Head, M.D.
LATHES, Turret Warner & Swasey #4 G.H., M.D.
LATHES, Lo-Swing 4"x36" Seneca Falls
MILLING MACHINES, Milwaukee #1B Universal #2, Plain, M.D.
NIBBLERS, Gray & Savage
PLANER, Gray 36"x36"x12' two rail Hds.
PLANER, Ohio 42"x42"x10' One Head, M.D.
PRESS, DDG34 Ferracute, D.A.
THREAD ROLLER, Watson-Flagg. Late type—3/16" to 2½" cap.

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G & E 24" Cin. 32" Shapers
Cleveland O.S. Planer 36"x8', 2 hds.
American 4' Radial Drill, encl. hd.
Cincinnati D. H. Planer 36"x36"x10', 2 hds.
Barnes geared Camelback Drill Press, 4 sp.
Bullard Vert. Turret Lathes, 24" & 36" S. Head
Defiance 3" Horiz. Boring Mill & Univ. #3-A
L & S 18x12' & 20'x10' 20"x8' Grd. Hd. M.D.
& 28"x12' Lathes
American 24'x12' grd. hd. lathe, m.d. q.c.g.
Amer. 4-ton vert. Hydr. Broach
Blanchard Vert. Surf. Grinder, 26 rd. chuck.
Cincinnati #2 Centerless Grinder.
Colburn 60" Vert. Boring Mill
Cincinnati 1-M grd. hd., Univ. tool room Miller.
Cincinnati No 5 H.P. grd. hd. S.P.D. Pl. Miller.
Milwaukee No 3-B Vert. Miller grd. hd., m.d.
Cin-Bick 3' Super Serv. Radial
Gisholt 3R Grd. Hd. M.D. Turret Lathe
W.&S. No. 2A grd. hd. Univ. Turret Lathe, S.P.D.
Foster No 2F Fastermatic grd. hd. Turret Lathe, M.D.

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Abrasive No. 1½ Surface Grinders, M.D.
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DRILL, RADIAL—FOSDICK 3½". G.B., M.D.
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TURRET LATHES—FOSTER No. 1-B Univ. inc. 2 Wrenchless Chucks, etc. M.D.; also W & S No. 2-A Univ.
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National Bent Shank Nut Tappers—Battery of ⅝" and ⅞" Machines.
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Shapers, 16"-20"-24"-36"
Shaper, 36" Morton Draw Cut

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LATEST TYPE NEARLY NEW MACHINES

Available for Prompt Shipment

Nearly All Built After 1941

AUTOMATIC SCREW MACHINES
CLEVELAND ⅞" to 2½" Model A
CONOMATIC 3½" 4 spindle—latest type
NATIONAL ACME 9/16" mod. C, 5 spdle., M.D.

BORING MILLS—Horizontal
FRANKLIN 4½" bar, single pulley drive
GIDDINGS & LEWIS #25, 2⅝" bar, M.D.
LUCAS #31—3" bar—motor drive
NILES BEMENT POND 5½" bar—M.D.
NILES BEMENT POND 4½" bar—floor type—M.D.
NILES-BEMENT-POND 5", 6", 7" bar—floor type—M.D.
OHIO #5F-420 5" bar Floor type, latest type
P & H #10—3½" bar—floor type—M.D.
PETRICK 3½" bar, floor type, M.D.

BORING MILLS—Vertical
BETTS 120"—2 swivel heads, motor drive
BULLARD 24", 36", 42" New Era Type M.D.
BULLARD 86"—2 swivel heads—motor drive
COLBURN 72' 2 swivel heads, AC, M.D.
KING 30" Vert., M.D.
KING 72" 3 heads, AC, M.D., Latest type
KING 62" 2 swivel heads, PRT, AC, M.D.
NILES 42"—2 swivel heads; power rapid traverse
NILES 73"; 2 swivel heads; AC; M.D.
NILES BEMENT POND—100" two swivel heads, PRT Motor Drive

DRILLS
BAKER #121 Single spindle—latest type
BARNES #H3, Hydram, latest type
BAUSH #2, #3, Multiple spindle, M.D.
BODINE #42-20, 42-30 auto, M.D.
COLBURN #14, 2 spindle, heavy duty, AC, M.D.
EDLUND No. 1B, single spindle, M.D.
EDLUND No. 2MS, 2 spindle, M.D.
FOOTE BURT SIPP #2, #3—single spindle—latest
HENRY & WRIGHT 2 spindle
NATCO C-13H multiple spindle
PRATT & WHITNEY No. ½Bx50" 2 spdle. Deep Hole—latest type

DRILLS—RADIAL
AMERICAN 4'11", 5'13" triple purpose, M.D.
AMERICAN 4'11", 5'11", 5'13" triple geared, AC, M.D.
BICKFORD 4'11", 5'11", 5'13", AC., M.D.
CANEDY OTTO 3'11" New
CARLTON 3'11", 6'17", 7'19", latest type
CARLTON 4'13", 5'14", 6'15", M.D.
CINCINNATI BICKFORD 4'11", 5'13", plain, M.D.
CINCINNATI BICKFORD 6'19", Super Service, M.D., latest type
DRESES 4'13", 5'15", AC, M.D.
FOSDICK 5'14" AC, M.D.
MORRIS 3½'9", 4'11" AC, M.D.
MUELLER 4'11", 4½'9", AC, M.D.
NILES BEMENT POND 6'15" uni., AC, M.D.
REED PRENTICE 4', 6', AC, M.D.
RYERSON 4'11" AC, M.D.
WESTERN 3' single pulley drive
WESTERN 4'18"; 5'18"; 6'20"—latest type

GEAR CUTTING EQUIPMENT
BARBER COLMAN Type S hobber, latest type
BARBER COLMAN No. 3 Gear Hobber
BARBER COLMAN #12 hobber, M.D.
BROWN & SHARPE #3H gear cutter, M.D.
FELLOWS #7, #7A, 72, 77 gear shaper
FELLOWS #7125A, 75A, latest type
GLEASON #13 tester, M.D.
GLEASON 24" Bevel Gear Planer
GLEASON 18" bevel gear generator
GOULD & EBERHARDT 18H, Uni. hobber, M.D.
G & E #96H Gear Hobber, with differential

GRINDERS—Cylindrical—Plain & Univ.
BROWN & SHARPE #1, #3, #4, Uni., M.D. latest type
BROWN & SHARPE #5 Plain 3x12 latest type
LANDIS 6x20 6x18 Plain—motor drive
LANDIS 12x36 Universal Type LC Hydraulic; latest
NORTON 10x18 plain, M.D.
NORTON 14x48 Univ. Type C Multi-purpose HYD., latest type

GRINDERS—Internal, Cutter and Misc.
BROWN & SHARPE #13, Uni., and tool, M.D.
BRYANT No. 16—16" Chucking—Internal—latest
BRYANT #5 internal, hyd., latest type
FITCHBURG Uni. spline shaft, hyd.
GLEASON #12 cutter grinder
HEALD 72A3 Sizematic Internal, latest type
HEALD 72A5 Plain internal dial type, latest type
LEBLOND #2 uni., tool and cutter, latest type
PRATT & WHITNEY Contour Cutter—latest type
SELLERS #4T Univ. tool—latest type

GRINDERS—Surface
ABRASIVE #3 22x8x12, M.D.
ARTER, 8" Rotary Surface
ARTER 30" Rotary Surface—Hydraulic—latest
ARTER Automatic Piston Ring
BLANCHARD #16A—Dial Type—motor drive
BLANCHARD #16—26" Chuck—motor drive
MATTISON 16x24x96—Hydraulic—latest type

LATHES—Engine & Mfg.
AXELSON 24"x72" centers—Timken—latest
BRIDGEFORD 36"x28', 36"x32', 36"x35', 42x35', bed—2 carriages
HENDEY—12x54 centers—Mfg.—latest type
LEBLOND 13"x4' bed—Timken—Mfg.—latest
LEBLOND 17"x14' bed, Mfg., Timken—latest
LEBLOND 20"x48', centers—Timken Mfg., latest
LOSWING 4x34, 4x60, 8x34, 8x108, 8x60—Timken Bearing—latest type
LOSWING 10x34 Model LR Auto., Timken, latest
NILES 36"x25 centers, 2 carriages; PRT; Timken Bearing, latest type
PITTSBURGH 50'x30' bed—M.D.

LATHES—Turret
BARDONS & OLIVER #3 latest type
BARDONS & OLIVER No. 5, No. 7 Univ., Timken Bearing, chucking; latest type
BROWN & SHARPE #1 Hand screw machine, Timken bearing—latest type
CINCINNATI ACME #5W—Timken Bearing—latest type—2" Bar Cap.
CINCINNATI ACME #1 Uni.—Timken—latest
GISHOLT #3, #4 Univ. Timken Bearing—latest
GISHOLT #3D Simplimatics—Timken—latest
GISHOLT #4L, 9" hole—cross sliding Turret—Timken Bearing—latest type
GISHOLT #1L, #2L, uni. Timken bearing, latest
JONES & LAMSON #3, #5, #7C Univ.; latest type—Timken Bearing
LIBBY #1H-5 Timken Bearing—latest 5½" hole
MOREY #2G, 1" cap.—Timken Bearing
MOREY #3 Univ. 1½" Cap.—Timken Bearing
MOREY #4 Univ.; 2 cap., Timken Bearing
WARNER & SWASEY #3, #4, #5, Univ., Timken Bearing—latest type
WARNER & SWASEY No. 1A, 3A, 4A, Univ., Timken M.D.

MILLING MACHINES—Manufacturing
BRIGGS Type 2A Production, Hydraulic, latest type
BROWN & SHARPE #12 auto., Timken, latest
CINCINNATI 4-36 Hydro. Timken Bearing—latest
CINCINNATI #08 Vert.—Pl. Auto.—Timken Bearing—latest type—Rise & Fall
CINCINNATI #1-12, #1-18 Plain Auto.—Timken Bearing, latest type
CINCINNATI 48" duplex, automatic, SPD
KEARNEY & TRECKER #1218 Auto.—Timken Bearing—latest type
MOREY #12M 2 spdle Profiler & Milling Machine
NICHOLS hand, M.D.—latest type
OHIO Auto. 16"x72" table—Timken Bearing—latest type—36" longitudinal feed

MILLING MACHINES—Plain
CINCINNATI #4S High power, motor in base
CINCINNATI #5 high powered, M.D.
KEARNEY & TRECKER #3K, Timken, latest
KEMPSMITH #4 Maximiller—Timken latest

MILLING MACHINES—Universal
AMES Bench, Timken Bearing, latest type, M.D. 1" collet.
BROWN & SHARPE #3A Timken Bearing—dual control—latest type
ROCKFORD #2B—motorized

MILLING MACHINES—Vertical
BROWN & SHARPE #5—motor drive
CINCINNATI #2, #4—Dial Type—Timken Bearing—latest type
COCHRANE BLY Uni. Vert. Shaper-Miller; M.D.
KEARNEY & TRECKER #3K, Timken, latest

PLANERS
BELMAR 36x36x10' 2 heads, AC, M.D.
BELMAR 48x48x12' 3 heads, AC, M.D.
BICKETT 36x36x12' 3 heads, AC, M.D.
CHANDLER 36x36x20', 4 heads, AC, M.D.
CINCINNATI 24" Crank—motor drive
CINCINNATI 36x36x5' Box Table, PRT, 1 head—motor drive
CINCINNATI 48x48x20', 3 heads, AC, M.D.
CINCINNATI 120x96x20'—4 heads, box table—PRT—motor drive
CINCINNATI 36x36x8', 2 heads, AC, M.D.
CINCINNATI 42x36x12', 2 heads, AC, M.D.
CINCINNATI 60x48x14' 4 heads, AC, M.D.
CLEVELAND 48x48x16' Opensides 3 heads, M.D.
DETRICK & HARVEY 48x48x10', 12' open side, 3 heads, M.D.
DETRICK & HARVEY 48x48x16' 4 heads, Hyd., M.D.
GRAY 44x36x12', 4 heads, AC, M.D.
GRAY 48x48x14', 4 heads, AC, M.D.
GRAY 54x42x10', 2 heads, AC, M.D.
GRAY 60x48x16', 3 heads, AC, M.D.
HAMILTON 42x42x20', 4 heads, motor drive
HAMILTON 48x48x16', 4 heads, DC, M.D.
LIBERTY 36x36x9', 3 heads, AC, M.D.
LYND FARQUHAR 26" Openside, motor drive
NBP 36x36x10', 3 heads, DC, M.D.
NBP 42x42x12', 2 heads, AC, M.D.
NBP 48x48x14', 16', 2-4 heads, AC, M.D.
NBP 54x54x12', 2 heads, box table, AC, M.D.
NILES 48x48x12' Time Saver, 3 heads, power rapid traverse, box table, DC, M.D., latest type
NILES BEMENT POND 96x80x20' box table 4 heads Hyd. PRT—motor drive
OHIO 36x36x10', 2 heads, AC, M.D.
OHIO 42"x42"x20', 2 heads, AC, M.D.
PATCH 48x48x14', 4 heads, DC, M.D.
POND 42x42x12', 2 heads, AC, M.D.
POND 48x48x16', 2 heads, AC, M.D.
PUTNAM 48x48x18', 4 heads, AC, M.D.
WOODWARD & POWELL 36x36x12', 4 heads, AC, M.D.
WOODWARD & POWELL 42x42x10', 4 heads, AC, M.D.
WOODWARD & POWELL 84x48x18', 2 heads, AC, M.D.

SAWS
BRIDGEPORT #48W Abrasive
CAMPBELL No. 213 Wet Abrasive Cutoff, latest
CAMPBELL #401 Cutamatic Wet Abrasive—latest
GROB #OS-20 band, latest type
LUCAS #138 cold saw, motor driven
MAQUOKETA 10x10 hack, M.D.
MARVEL #9, 10x10 Hack; latest type
MOTCH & MERRYWEATHER #3 Cold Saw—Hyd.—latest type
PEERLESS 14x14 Hack; latest type

SHAPERS
BETTS 18" vert, slotter, DC, M.D.
CINCINNATI 28" horiz. double head
COCHRANE BLY Uni. Vert. Shaper-Miller; M.D.
JONES 6" Vertical—latest type
LAMAIRE 18" Vert. Hydraulic—latest type
MOREY 10", 14" Vertical—latest type
NEWTON 15" vert. slotter, DC, M.D.
NILES 18" vert. slotter, DC, M.D.
PRATT & WHITNEY 6", 10" Vertical, Motor drive

THREAD MILLING MACHINES
MOREY SHIELDS 12x120, 12x192—latest type
PRATT & WHITNEY 4½x12, 6x20, Model C—latest
PRATT WHITNEY 6x132—motor drive

MISCELLANEOUS
BARNES #2 SS Hone—latest type
BILLINGS & SPENCER 200, 400, 800 lbs. Board drop hammer
COLONIAL Model HAS-25-72 Universal, Broach, horizontal, hyd., 25 ton cap.
FERRACUTE No. DG-55 Drawing—latest type
FISHER #1 Oil Groover, M.D.
LEBLOND #2 Horiz. Hone—SS
LEBLOND #2 Deep Hole Borer; latest type
MORTON 60" Combination Traveling head Planer, Milling & Drilling
NILES 30"x50' Deep Hole Borer, Timken latest
PRATT & WHITNEY #3B Jig Borer, latest type
WHITON 8x108 Duplex Centering, M.D.
YODER Mult. Tube Cutting Machine

MOREY MACHINERY CO., INC.
410 BROOME ST., NEW YORK 13, N. Y.
TELEPHONE: CANAL 6-5360
CABLE ADDRESS: WOODWORK, N. Y.

AUTOMATICS—Swiss, Gorton 16A—5 slide 7/16" cap, all attachments 1944
Swiss, Ceco—5 slide 1/2" cap, all attachments 1944

BRAKES—D&K 12'x3/8, leaf type
D&K, apron type, 8'x16 g, power

GRINDER—Centerless, Zephyr #2M (1945)

HAMMERS—Board Drop, Billings & Spencer, 1400 lb.
Board Drop, Billings & Spencer 1600 lb.

JIG BORER—Sip Swiss MP 3C—like new

LIFT TRUCK—Electric—2 ton—platform 38" x 54" with charger

LATHES—Engine LeBlonde 21" x 10' Q.C.
(2) Engine Monarchs 16" x 8' motor in base taper

POWER PRESSES

Air Hydraulics—2½ ton cap. New V&O #0—2/Bliss #18 Plain & geared—1/#19

Make	Tons	Die Space	Stroke	Shut	Type
Bliss #172A	22	5"x 4"	1½"	7"	End Wheel
Bliss #68C	35	21"x10½"	1-2½"	7"	Arch-DA
Adriance #155	40	29"x36"	1½"	10"	OBI-SA
Torrington	40	23"x16"	1-2"	6¼"	SS-DA
Bliss #1B	43	14"x20"	3-6"	8½"	SS-DA, Gap
Hibbard	50	20"x25½"	2"	10"	OBI
(2) Bliss #52	40	13"x15"	3"	9½"	SS-SA
(3) Consolidated #54	56	17"x18"	3½"	12"	Trimmers-Shear

Make	Tons	Die Space	Stroke	Shut	Type
Bliss #4½	75	21"x26"	1½"-4½"	18"	SS-DA, Geared
(2) Bliss #7	180	28"x36"	1½"-4½"	13"	SS-DA, Geared Air Clutch
Toledo #59½S	500	31"x31"	8"	29"	SS-SA, twin drive
(3) Mystic #5A	40	14"x17"	6"	14"	Embossing & Moulding for Plastics

RIVET COUNTERSINKING MILL—Farnham 36" reach
ROLLS—Pyramid, open end, 8' x 1/4"
SAWS—Kalamazoo metal cutting, New
SHEARS—Bliss 42" x 3/16" Squaring, power, gauges
Niagara 10" x 10 G, Squaring, power
Bliss 24" x 3/16, power, gages
Whitney Jensen 42" x 16" G, power, like new
(8) TURRETS—Denver 6" motor in base air chuck, late

KINGS COUNTY MACHINERY EXCHANGE

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MDNA MEMBER

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IMMEDIATE DELIVERY FROM STOCK

No. 4½ BLISS, 80-100 Ton Capacity straight side punch press, late model with scrap cutters, double roll feeds, bolster. 10 H.P. motors and controls, forced feed lubrication. 21x27 bolster 4½" stroke. In both Single and Double Action Models. Like new, no welds or no cracks.

No. 6 BLISS, 90-125 Ton Capacity, straight side Punch Presses, late model. With scrap cutters, roll double roll feeds, bolster, 15 Hp motors and controls, forced feed lubrication. 25x30" bolster, 5½" stroke. In both Single and Double action models. Like new.

4½—75 ton straight side punch presses adjustable strokes, late model, motorized.

375 Ton ELMES Hydraulic Press, 48x64 bed, comp. with all standard equipment, new 1943.

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5" AJAX UPSETTER, M. D.

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Blueprint machines, printer-washer-dryer
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Simmons No. 1A Micro Milling Machine
Drills, high speed single & multiple spindle
Drill, 21" Royersford Bk. Grd. Pr. Feed, New
Drills, sensitive, 2 and 4 Spindle
Drill, #25 Foot-Burt, motor driven
Drills—New—18" Royal Motor driven (10)
Gear cutter, Brown & Sharpe #3—26
Gear cutter, Gould & Eberhardt 42"
Grinder, Webster and Perks #1-⅝ motor drive
22" **Buffalo** Pr. Fd. Motor Drive, New
16"x6' **Hendey Lathe,** Quick Change Gear
Magic Chucks #1-2 & 3 and Collets
Pipe Machine, 3" Oster motor drive
Planer 24"x24"x8' Pease, motor drive
Punch & Shear, two ½" & ⅝" capacity
Shaper, 24" Gould & Eberhardt
Turret Lathe, 2" Acme & Warner & Swasey
Welders—Arc & Spot in Stock—New

Outfit: about 27 fine machine tools, drills, lathe, and 5 milling machines, plain and Uni. Tell us definitely what you want as our list is incomplete and only partial.

The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

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COLUMBUS, OHIO

TURRET LATHES
Latest Type

2—#3 WARNER & SWASEY Universals 1945 Machines, Tooling, FOB Buffalo, N. Y.

5—#4 WARNER & SWASEY Universals, Preselector heads, considerable tooling, FOB Buffalo, N. Y.

1—#1A WARNER & SWASEY Universal, Preselector head, over head pilot bar, tooling, FOB Buffalo, N. Y.

O'CONNELL MACHINERY CO.
1827 Niagara St., Buffalo 7, N. Y.
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AUTOMATICS

Gridley, 2⅝" Model RA., 4-spdl., motor 3/60.
Cone, 1⅞" Plain Bearing, 8-spdls., MD. (2)
Gridley, 1¼" Model C., 4-spdl. with motor.

LATHE

9" Hendey Gaugemaker's motor in base, TA., Oil Pan, Cabinet Base, Dial Speed Control, Collets, Bar Attachment & Chuck.

MILLING MACHINES

Van Norman #2-SU. Universal with 5 HP. Motor of 3/60/220 V. New 1940. (2).

GALBREATH MACHINERY CO.
Empire Building Pittsburgh, Pa.

FOR SALE

AIR COMPRESSORS ER-1, 12x18 AC Motor Drive, 275 CFM (4)
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MILLING MACHINE, 0-8 CINCINNATI, (rise and fall att.)
MILLING MACHINE, LeBlond #3 Plain
CHUCKERS, NEW BRITAIN GRIDLEY, 4 sp. No. 412. (3)
LO-SWING AUTOMATIC LATHES 14"x32" (8)
5"x22" (3)
SLAB MILLERS 36"x30"x14' Ingersoll
CLEVELAND HOBBING MACHINE CO. 8 sp. RIGIDTURNER
ENGINE LATHE 32"x14' ALLIANCE, QCG, GEARED HEAD
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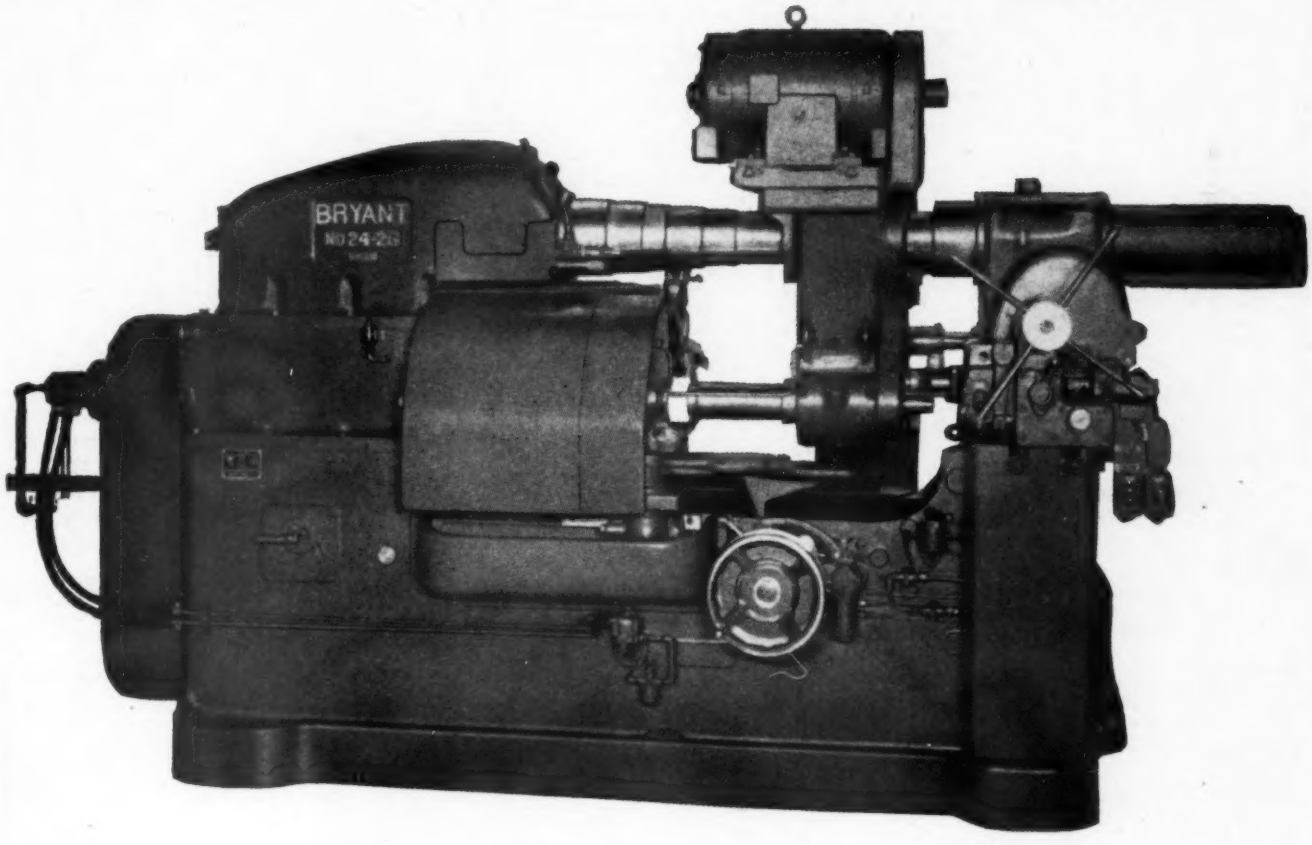

24-26" BRYANT HYDRAULIC INTERNAL GRINDER

(slightly used)

Extremely massive construction. Built to take heavy cuts with accuracy and smoothness. SINGLE LEVER CONTROL. HYDRAULIC. Nothing else to buy. These machines—in stock now—have all 3 motors and electrical equipment, hydraulic pumps, coolant pump and tank and other extras. Ready to go *NOW!*

Are your jobs similar to these:

Crankshaft parts, propeller hubs, boxes, engine crank cases, aircraft parts, engine cylinders. Standard chucks work holding fixtures and attachments can be used on these machines.

Specifications

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Avey & Allen 3, 4, 5, & 6 Sp.
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B. & S. No. 13 Univ. & Tool.
Abrasive Nos. 33 & 34; No. 3B.
Norton 6"x18" Hyd. Surface.
Norton 6"x10"x36" Surface.
Norton 15"x15"x72" Surface.
Norton 6x32, 10x24, 10x50 Plain.
B. & S. Nos. 10, 11, Plain.
Bryant Nos. 3B, 5, 6, 12 Internal.
Heald No. 70-A, Internal.
Landis 12"x32", 20"x120", 20"x144" Plain.
Cincinnati No. 1½ Tool & Cutter.
LeBlond No. 2 Tool & Cutter.
Norton No. 2 Tool & Cutter
Cincinnati No. 2 & No. 3 Centerless.
Cincinnati No. 3 Centerless Lapper.
Fitchburg 36" Spline Grinder.
Blanchard No. 16—30".
Blanchard No. 18 Rotary Surface.
Heald No. 25—A Rotary Surface.
P. & W. 14" Vert. B.B.
Barber Colman No. 3 Hobber & Grinder.

LATHES

Hendey 14"x6' Y.H.
American 16"x6'—G.H.
Lodge & Shipley 20"x8', G.H.

MILLERS

Brown & Sharpe No. 2 Lt. Type Plain.
Milw. No. 2B & 3B Double Overarm.
K. & T. No. 5H Plain.
B. & S. No. OY Production.
Cin. No. 2 Plain; Nos. 3, 4 Vert.
Becker Model C, Vertical.
Becker No. 7H, Plain.
B. & S. No. 3B & 5B Plain.
Rice-Barton 4" Spline.
P. & W. 8", 10" & 12" Automatic.
Cincinnati 18" & 24" Production.
Sundstrand No. 1-18 and No. 2 Electromil.
P. & W. 6x14 & 6x72 Thread.
Lees-Bradner 6"x36" Thread.

PLANERS

Cincinnati—48"x48"x20', 3 Head.
Powell 48"x48"x12', 4 Head.

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B. & S. No. 00, 0, 2 Automatics.
B. & S. No. 1 & 2 Hand Screw.
Potter & Johnson No. 6-C Chuckers.
Cleveland 1⅜" Model AA.
W. & S. Nos. 1, 2, 2A, 3A Universal.
Foster No. 7 and No. 1B.
Cone 1¼" 4 Spindle.
Cleveland 3¾" Model A, Latest Type.
Cone 3½"—4 Spindle.
Cleveland 6¾", Model A.
Cleveland 7¾", Model A.
Gridley ⅜", 1¼", 1¾" & 2⅝", Model G; 3¼" & 4¼".

MISCELLANEOUS

Borematic—Heald No. 47-A.
Boring Mill—Gisholt 30".
Boring Mill—Bullard 42" New Era.
Boring Mill—Bullard 100" Head.
Cutoff Machine—Abrasive No. 213.
Fay Automatic.
Fellows Gear Shaper No. 7.
Hammers—Bradley.
Rock Shaper—Fellows 4"x72".
Slotter P. & W. 6" Vert.
Trimming Mach.—V. & O. No. 202½.
Turret Lathe—W. & S. No. 3 Late Type.

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BOR. MILLS, 2½" bar, Cleveland, M.D.
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BOR. MILL, 36"-44" N-B-P, Tur. & Side Hds.
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BROACH, Hr. Hyd. XA Oilgear, 66" stroke.
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DRILLS, Radial, Hyd. 4' Fosdick, Economax.
GRINDER, Internal, No. 72A5 Heald, 2 Mtr.
GRINDER, Plain, 14"x72" Norton, M.D.
GRINDER, Rot. Surf., No. 25 Heald, M.D.
GRINDER, Surf., No. 2 Diamond, 16x36.
GRINDER, Surf. No. 16 Blanchard, M.D.
HAMMER, Beard Drop, 1,000#, B & S.
HAMMERS, Steam Drop, 5,000#, & 12,000#.
JIG BORER, N. 2 Pratt & Whitney, M.D.
LATHE, 24"x16' American, Grd. Hd., Q.C.G., T.A.
LATHE, 36"x22' N-B-P, Grd. Hd., Q.C.G.
LATHE, 36"x19' Putnam, Grd. Hd., Q.C.G., T.A.
LATHE, Turret 6W Asmo, 3" h.s., Mtr. in base.
LAPPER, No. 1 Micrematic Hone (New)
MILLER, Duplex 24" Cincinnati Auto.
MILLER, Plain, Nos. 3S, 4 & 5 Cincinnati.
MILLER, Univ. No. 1½ K & T, No. 3A B & S.
PIPE MACHINE, Landis, Cap. 1"-6".
SHAPERS, 24" Cincinnati, 28" G & E.
SHAPER, Vert. 10" Pratt & Whitney.

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2-TON—Louden 19'2" Span
Box 38'8" Span
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3-TON—Shaw 33' Span
P & H 23' Span
Northern 22' Span
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"Conco" 48' and 26'6" Spans
5-TON—Whiting 47'4" Span
38' 10½" Span D.C.
Northern 30'9" Span
Milwaukee 70' Span
Milwaukee 66'9" Span
Manning, Maxwell, & Moore 70' Span
Manning, Maxwell, & Moore 47'4" Span
Shaw 36' Span
Champion 37'6" Span
American 70' Span
American 47'4" Span
6-TON P & H 77' Span
American 77' Span
7½-TON—Shepard 36' Span
10-TON—Shaw 68' Span
Shaw 73' Span
P & H 30' Span
P & H 87'6" Span
P & H 80' Span
Northern 71'10½" Span
Northern 60' Span
Morgan 55'6" Span
Morgan 39'5" Span
Morgan 52'3" Span
Milwaukee 66'9" Span
McGill 85' Span
Lane 50' Span
Emsco 75' Span
Dominion 35' Span
Cleveland 38½" Span
Cleveland 50' Span
Alliance 71'10½" Span
Alliance 58'9" Span
Albany 60' Span
15-TON—Whiting 71'-10½" Span
Northern 53' Span
Erie 60' Span
Chesapeake 55'6" Span
Case 51' Span
20-TON—Shepard Niles 49'6" Span
P & H 51'4" Span
Northern 60' Span
Morgan 60' Span
Cleveland 65' Span
25-TON—Whiting 106' Span
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P & H 70' Span
Morgan 52'3" Span
Cleveland 106' Span
Case 63' Span
Bedford 56' Span
30-TON—Whiting 80' Span
P & H 80' Span
P & H 60' Span
Morgan 30' Span
Case 41' Span
35-TON—Bedford 58' Span
Northern 22' Span
50-TON—Shaw 85' Span
Shaw 69'10" Span
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Cleveland 71'10½" Span
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Alliance 78' Span
Alliance 37' Span
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125-TON—Morgan 100' Span
150-TON—Whiting 50' Span
175-TON—Morgan 54' Span
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All Built In 1943

12"x30" MONARCH Lathe, flame hardened bed; Timken Bearing
16"x30" MONARCH Lathe, flame hardened bed; Timken Bearing
20"x48" MONARCH Lathe flame hardened bed; Timken Bearing
22"x48" LODGE & SHIPLEY, selective head, Lathe, 24 spindle speeds.
#2HL K. & T. Vertical Mill.
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Capacity 6 to 8 Rims per minute. Diameter of jaws fully contracted 34". Motor driven. Specifications by request.

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Bardons & Oliver #3 complete with chuck and collets; motor drive, 220-440/3/60.

Grand Rapids Blow Pipe Blower; 3300 CFM; complete with motor, 220-440/3/60.

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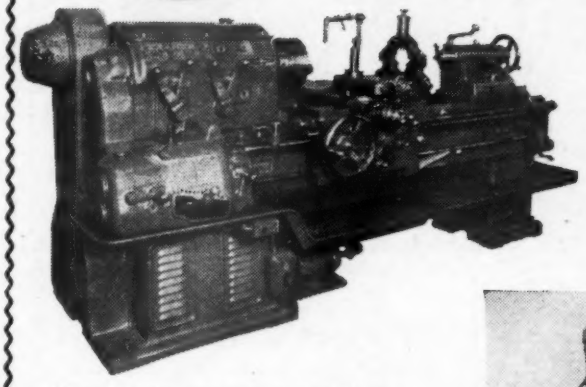

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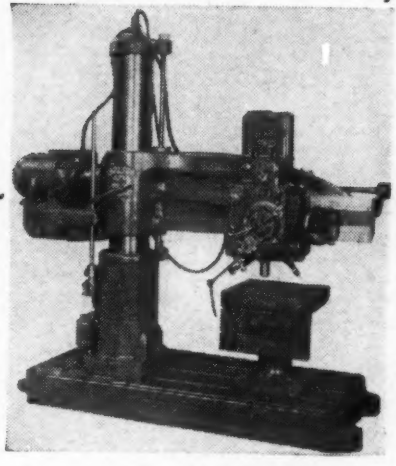
At right: 4' Carlton Radial Drill



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2½' Cincinnati-Bickford Super-Service, m.d. on arm, latest
3' American Sensitive, belt
3'-11" American Triple Purpose, m.d. on arm
3'-11" American Triple Purpose, with 4' arm and base, m.d. on arm
3'-11" Carlton, m.d. on arm, latest
3' Fosdick Sensitive, s.p.d.
4'-11" American Triple Purpose, m.d. on base
4'11" American Hole Wizard, m.d. an arm, latest
4'-11" Carlton, m.d. on arm, latest
4'-13" Cincinnati-Bickford, gearbox on base
4'-12" Fosdick, gear box on base
4' Niles-Bement-Pond Semi-Universal, m.d.
5' American Triple Geared, 13" column, gear box
5' Cincinnati-Bickford Plate hole Drill, m.d. on arm
5' Prentice Plain, m.d.
6'-15" American Triple Purpose, m.d. on base
6'-17" American Hole Wizard, m.d. on arm, railroad type base, latest
6'-15" Carlton, gear box on base
6'-15" Cincinnati-Bickford Full Universal, gear box on base
6' Niiles-Bement-Pond Semi-Universal, m.d.
6'-16" Western, m.d.
7'-15" Cincinnati-Bickford, m.d.
8'-16" American Triple Purpose, m.d. on arm
10'-22" American Triple Purpose, m.d. on arm

HORIZONTAL BORING MILLS

No. 32 Giddings & Lewis, m.d.
No. 0 Giddings & Lewis, m.d., 3⅛" bar
No. 21 Lucas, m.d., 2½" bar
No. 31 Lucas, m.d., 3" bar
4" bar Detrick & Harvey Floor Type, m.d.
4" bar Landis Floor Type, m.d.
4½" bar Niles, table type, motorized
5½" bar Niles, m.d., table type
4" bar Niles, m.d.
6" bar Niles-Bement-Pond, floor type, m.d.
10" bar Sellers Floor Type, m.d.
60" stroke Morton Boring Mill and Draw-Cut Traveling Head Planer, m.d.

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No. 2A Brown & Sharpe, m.d.
No. 3A Brown & Sharpe, m.d.
No. 4A Brown & Sharpe, m.d.
No. 4 Cincinnati, m.d.

ENGINE LATHES

14"x6' American Geared Head, m.d.
14"x6' Hendey Geared Head, m.d., taper
14"x6' Pratt & Whitney, cone, taper
14"x8' Pratt & Whitney, cone
16"x6' Bradford, cone, motorized, taper
16"x6' Hendey Geared Head, m.d.
16"x6' Hendey Geared Head, m.d., taper
16"x6' Sebastian Geared Head, m.d. in base, latest
16"x6' Lodge & Shipley Selective Head, m.d.
18"x7' Hendey Geared Head, m.d., taper
18"x8' Hendey Geared Head, m.d.
18"x8' Lodge & Shipley Patent Head, m.d.
18"x8' Lodge & Shipley, cone, motorized
20"x8' Springfield Geared Head, m.d., taper
23"x12' LeBlond Geared Head, m.d., taper
24" raised to 28"x10' Hendey Geared Head, m.d.
24"x10' American Geared Head, m.d.
24"x72' centers Lodge & Shipley Selec. Head, m.d., taper, latest
24"x10' Lodge & Shipley Selec. Head, m.d.
25"x10' LeBlond, cone
26"x14' Bridgeford, cone, taper, motorized
27"x16' LeBlond, cone, taper

ENGINE LATHES (Continued)

30"x12'6" Niles-Bement-Pond Geared Head, m.d., taper
30"x13'6" Niles-Bement-Pond Geared Head, m.d.
30"x28' Lodge & Shipley Selective Head, m.d., 2 carriages
32"x16' Bridgeford Patent Head, m.d., taper
36"x10' Putnam, cone
36"x12' Wright, cone
36"x12' Lodge & Shipley Selec. Head, m.d.
36"x21' centers Putnam Geared Head, m.d.
36"x28'6" Niles Heavy Duty Geared Head, m.d., latest
36"x30' Lodge & Shipley Selective Head, m.d., 2 carriages
36"x32' centers Putnam Geared Head, m.d., 2 carriages
36"x36'6" Niles H.D. Geared Head, m.d., 2 carriages, latest

TURRET LATHES AND SCREW MACHINES

No. 1A Warner & Swasey Universal, m.d., preselector head, latest type, chuck
No. 1A Warner & Swasey, m.d., bar, as above
No. 1A Warner & Swasey, m.d., bar, latest
No. 1 Cincinnati-Acme Semi-Universal, m.d., chucking
No. 1L Gisholt Universal, m.d., chucking
No. 1L Gisholt Universal, m.d., chucking, long bed
No. 2 Cincinnati Acme Full Universal, m.d. in base, chucking, latest
No. 2 Cincinnati Acme Full Universal, m.d. in base, long bed type, chucking, latest
No. 2B Foster Universal, m.d., chucking
No. 2L Gisholt Universal, m.d., chucking
No. 2L Gisholt, long bed type, as above
No. 2G MoreyRam Type, m.d. in base, bar
No. 2 Pratt & Whitney Shaver, m.d.
No. 2 Warner & Swasey Geared Head, bar, Timken, latest
No. 2A Warner & Swasey Universal, m.d., bar
No. 2A Warner & Swasey Universal, preselector head, bar, latest
No. 2A Warner & Swasey as above, chucking
No. 3B Cincinnati Acme Fixed Center Universal, m.d. in base, latest
No. 3 Cincinnati Acme Full Universal, m.d., chucking
No. 3 Foster Geared Head, m.d., bar
No. 3B Foster Universal, m.d., bar
No. 3A Warner & Swasey Universal, m.d., bar
No. 3A Warner & Swasey Universal, m.d., chucking
No. 3A Warner & Sawsey Universal, m.d., electric chuck, latest
No. 3L Gisholt, m.d., chucking, Timken
No. 4 Gisholt Universal, m.d., bar, Timken
No. 4 Warner & Swasey, cone, bar
No. 4 Warner & Swasey Geared Head Universal, m.d., bar
No. 4 Warner & Swasey Universal, m.d., bar, preselector head, latest
No. 4 Warner & Swasey as above, chucking
No. 4A Warner & Swasey Universal, m.d., chucking, 7½" hole, Timken
No. 4R Cincinnati Acme, m.d., bar
No. 4L Gisholt, m.d., chucking, 9¼" hole, Timken
No. 5 Jones & Lamson Universal Ram Type, m.d., chucking, latest
No. 7 Bardons & Oliver Universal Ram Type, m.d., chucking, latest
2½x24" Jones & Lamson Geared Head, m.d., bar
3x36" Jones & Lamson Geared Head, m.d., chucking
3x36" Jones & Lamson Geared Head, m.d., bar
2 spindle 3x36" Jones & Lamson Geared Head, m.d., chucking
3¼" Cincinnati Acme Geared Head, m.d., chucking
3½x32" Jones & Lamson Geared Head, m.d., chucking
3½x32" Jones & Lamson Geared Head, m.d. bar
18" Libby Type A, m.d., chucking
20" Cincinnati Acme Flat Turret, m.d.
20" Acme, cone
24" Gisholt, cone
26" Libby Type C, m.d., chucking
28" Libby Type C, m.d., chucking, 7½" hole
28" Gisholt, cone
Woods Tilted Turret, model D, cone

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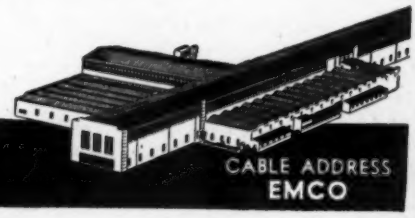

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36"x30' Lodge & Shipley Triple Geared Selective Head, two carriages
42"x18' Putnam Geared Head

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#3 Milwaukee Vert. M.D.
#3K Milwaukee Vert.
No. 4 Cincinnati Plain, Motor Drive
No. 4K Milwaukee Plain Late Type
No. 118 Van Norman Production
24" Cincinnati Production
Taylor & Fenn Spline
No. 27MB Smalley General Thread
#2 Hanson-Whitney Thread
No. 6 Lees-Bradner Thread
26"x25"x12' Ingersoll Adjustable Rail
42"x36"x14' Ingersoll Adjustable Rail, four heads

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7' American full Universal Radial

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34" King, s.p.d
42" Bullard New Era Vertical Turret
72" Colburn, Motor Drive
72" King, Motor Drive

HOR. BOR. MACHINES

No. 50 Universal, 5" Bar, 60x144" Table, Maximum Bar to Table 72", Maximum Bar to Outboard 120".

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No. 4 Pfauter, 72" Capacity

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36"x36"x8' Woodward & Powell
60"x38"x8' Gray Spiral Geared

TURRET LATHES

No. 2 Brown & Sharpe, Wire Feed
#3 W & S Univ. Bar Feed
#4 W & S Univ. Speed Selector
No. 1-A W & S Univ. Speed Selector
#4—W & S 1½" Screw Machine
#6—W & S 2" Screw Machine
#6.R Denver Univ. 2-9/16" capacity
18" Libby—3½" Hole—M.D.

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No. 16 Blanchard Surface, 26" chuck

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10x18	14x36	16x 50
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NORTHERN Heavy Duty 40" Precision Internal and External Grinders
NEWTON 4' Vertical Rotary Milling Machine
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52" & 72" KING Two Swivel Heads.
96" CINCINNATI, 2 swivel heads.
100" N.B.P. Vertical 2-swiveling heads
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14-20' N.B.P. Extension type boring—2 swivel heads, all geared feeds
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24"x24"x16' INGERSOLL Planer type.
#4-B B & S Double overarm.
Nos. 2 and 4 CINCINNATI High Power Vertical, Power rapid traverse.
No. 5 CINCINNATI Plain Rectangular overarm table 83"x21".
No. 3-36 CINCINNATI Duplex Hydromatic
6"x14" PRATT & WHITNEY, thread.

LATHES

24"x32' AMERICAN, 12 Speed, G.H.
30"x18' AMERICAN, 12 Speed, G.H.
36"x32' NILES, "Timesaver".
PUTNAM Double Axle Lathe, G.H.
30"x34' LEBLOND Gun Boring.
42" PUTNAM Car Wheel Lathe, G.H.
48"x70' N.B.P. Engine Lathe.
48"x30' SIMMONS, Geared head.
60"x30' NILES Heavy Duty Geared Head, M.D. (Built 1942).
60"x40' Centers MACKINTOSH-HEMPHILL Heavy Duty Geared Head M.D. (Built 1942).
90" PUTNAM Driving Wheel Lathe with journal truing and Double Quartering
No. 2-H LIBBY, Full Universal Cross Feeding Turret, Taper Attachment, M.D.

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6' AMERICAN, Triple Purpose Radial
8' AMERICAN, Triple Purpose Radial.
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No. 2 CINCINNATI centerless grinder.
24"x20' Centers NORTON Plain. Cylindrical individual motor drive to work spindle, wheel spindle and table.
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100" GOULD-EBERHARDT, Horizontal, for spur, helical and worm gears, capacity diameter 101" face 48".

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48"x48"x32' GRAY Spiral Drive, four heads, 230 volts, D. C.
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14'x9'x35' Capacity Detrick & Harvey Convertible openside, 2 rail heads, 2 side heads, traveling outer support, 230 V.D.C.

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6" & 10" PRATT & WHITNEY Vertical.
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36" MORTON Drawcut, Rotating Arber, Geared Feeds, P.R.T., M.D.

MISCELLANEOUS

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30"x⅞" N-B-P Bending Rolls
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No. 55 NEWARK Spur Gear Cutter.
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GRINDERS
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#33 Abrasive, Surface
Model B Thompson, Hydraulic, 12"x24" Surface
#2 Cincinnati Centerless

LATHES
14"x6' LeBlond Geared Head
15"x6' Sidney
16"x6' Porter-McLeod, Geared Head
16"x7' Lehman Hydratrol, Geared Head
17"x6' LeBlond, Taper Attachment
19"x8' Sidney
26"x12' Flather
36"x16' Bickford, Geared Head

MILLERS
#2 S.P. Van Norman, Plain
#2 Cincinnati, Vertical, Dial Type
#3 Cincinnati, Plain, High Speed, Dial Type
#4 Cincinnati, Universal

TURRETS
#5 Gisholt Universal
#3B Foster Universal
#2A Warner & Swasey
#4 Warner & Swasey

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#2L Van Norman Plain Miller

#2HS Cincinnati Vertical Miller

24" x 72" American "New Type T" Engine Lathe

12"x30" Monarch "CK" Lathe

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1—#2 B&S Universal Grinder
1—#0-8 Cincinnati Vertical Miller
1—Micromatic Hydrohoning machine
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2¾" bar Lucas horizontal
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5' Western

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14"x6' Hendey grd. hd.
14" x 6' & 18" x 6' American grd. hd.
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14" x 6' Mulliner
18" x 8' Springfield grd. hd.
36" x 16' Bridgeford geared head

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No. 3S Cincinnati plain
No. 3B Brown & Sharpe plain
No. 3B Kearney & Trecker vertical
No. 3 Reed Prentice vertical
No. 4 Cincinnati vertical
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Type C Hall planetary thread
No. 4 Lees Bradner univ. thread
12" Cincinnati plain Mig.
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4" Rice Barton double spline
Pratt & Whitney double spline
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Ingersoll drum type duplex

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33"x33"x8' Cincinnati, 3 heads
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15" Potter & Johnston universal
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32" Morton draw cut

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Honer, No. H-1 Micromatic Hydrohoner
Honer, No. 211 Barnes vertical
Lapper, No. 10 U Norton
Pipe machine, 6" Bignall & Keeler
Press, No. 10 Bliss reducing
Riveter, No. 5½B High Speed
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1" Ajax Upsetting & Heading Machine, AC motor, air clutch
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1" Waterbury Farrell Bolt Trimmer, AC motor
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3 HP Delta Disk Cut Off Mch., AC motor
Hack Saw Cut Off Mch., DC motor

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3-A Warner and Swasey Turret Lathe, Model 1950 Universal Type, Serial #605488 W, attachments. *In excellent condition.*

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Blanchard or Hanchett Rotary Grinder with Vertical Spindle. Must have 48" diameter or larger magnetic chuck.

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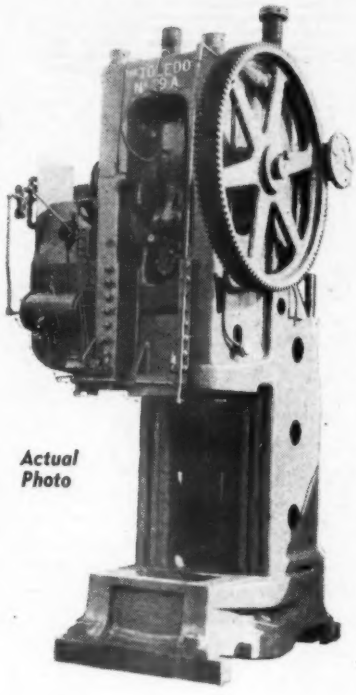
Four machines for immediate delivery — subject to prior sale.



Actual Photo

SPECIFICATIONS

Heavy Duty Gap Type
Rigid tie rod frame construction
Double back geared
Air clutch and brake
Capacity—approx. 135 tons
Area of bed 22" F to B x 36" R to L
Opening in bed 13" F to B x 24" R to L
Throat-distance center of slide to back . . . 15"
Stroke of slide . . . 14"
Slide remains below gibs on up stroke so large plate can be attached
Air counterbalanced slide
Adjustment of slide . . . 3"
Shut height on bed . . . 32" or less by attaching plates on bed and slide
Strokes per minute . . . 20 to 30
Weight—approx. . . . 40,000#
Motor required: 10 or 15 H.P.

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Of American Machinist, published every other Thursday at New York, N. Y., for October 1, 1946.

State of New York } ss.
County of New York }

Before me, a Notary Public in and for the State and county aforesaid, personally appeared J. A. Gerardi, who, having been duly sworn according to law, deposes and says that he is the Secretary of the McGraw-Hill Publishing Company, Inc., publishers of American Machinist, and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, as amended by the Act of March 3, 1933, embodied in section 537, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the name and address of the publisher, editor, managing editor, and business manager is: Publisher, McGraw-Hill Publishing Company, Inc., 330 West 42nd St., New York 18, N. Y.; Editor, Burnham Finney, 330 West 42nd St., New York 18, N. Y.; Managing Editor, E. J. Tangerman, 330 West 42nd St., New York 18, N. Y.; Business Manager, John H. Koch, 330 West 42nd St., New York 18, N. Y.

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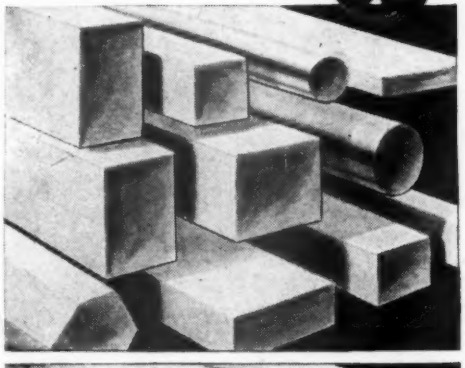

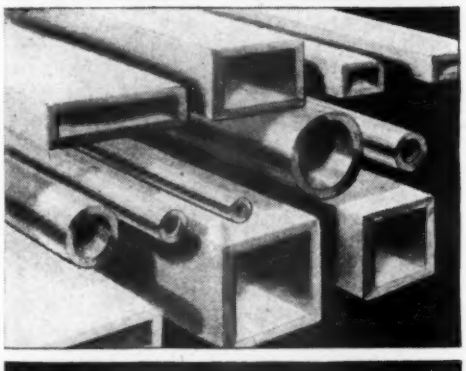

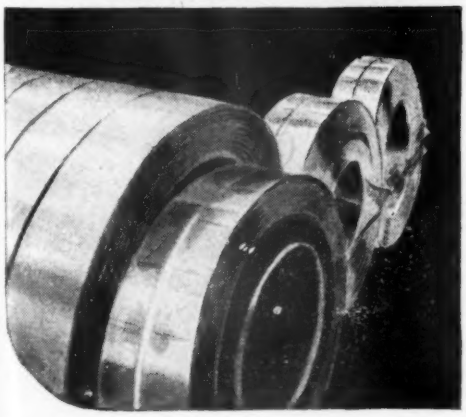

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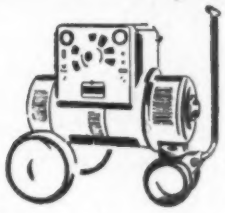

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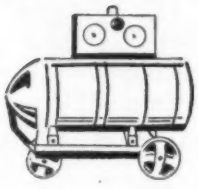

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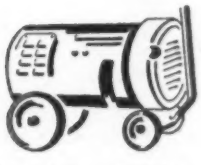

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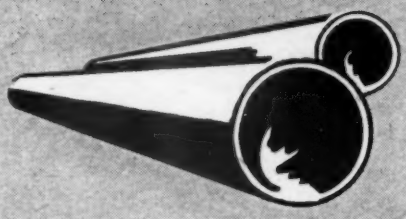

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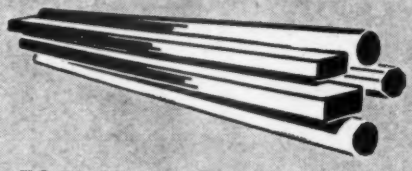

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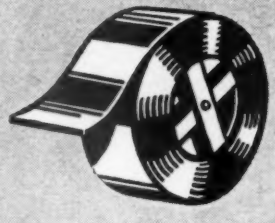

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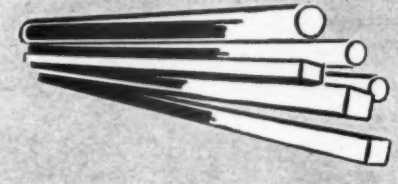

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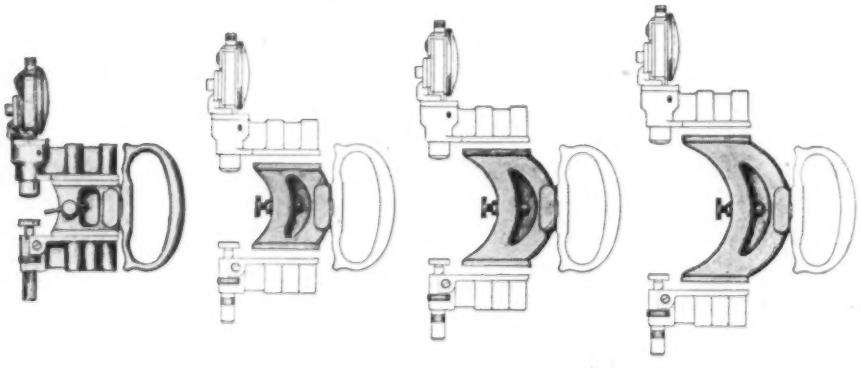

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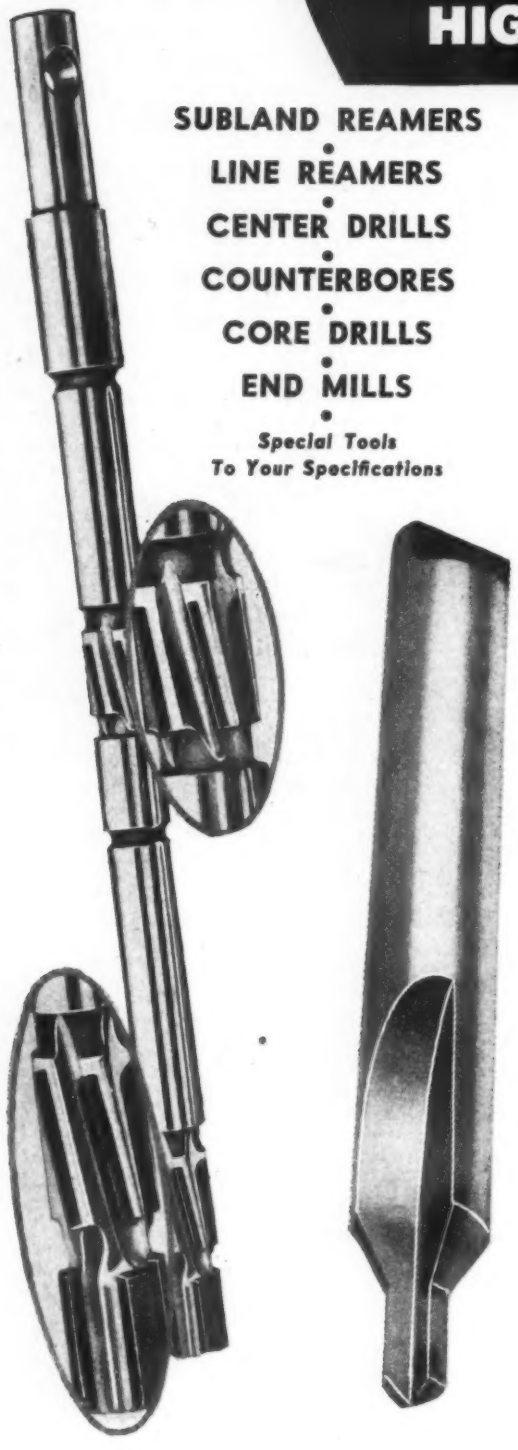
BRAZED ON HARDENED
HIGH-SPEED STEEL BODIES



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AGAIN, Detroit Reamer & Tool Company sets the pace in metal cutting tools, with brazed carbide tips on hardened high-speed steel bodies, so that the total length of flutes and pilots will Rockwell C-62-63.

It has also been proved in actual practice that this type of tool has a higher cutting efficiency due to the harder background for the carbide tips which produces less "spring-back" under heavy cuts for this same reason. Also, the flutes and pilots will not "score" or pick up due to the hardness of the high-speed steel and long wear on the pilot.

All of these outstanding advantages, together with longer tool life and reduced production costs, are at your disposal with Carbide Tipped Cutting Tools, with HIGH-SPEED STEEL BODIES.

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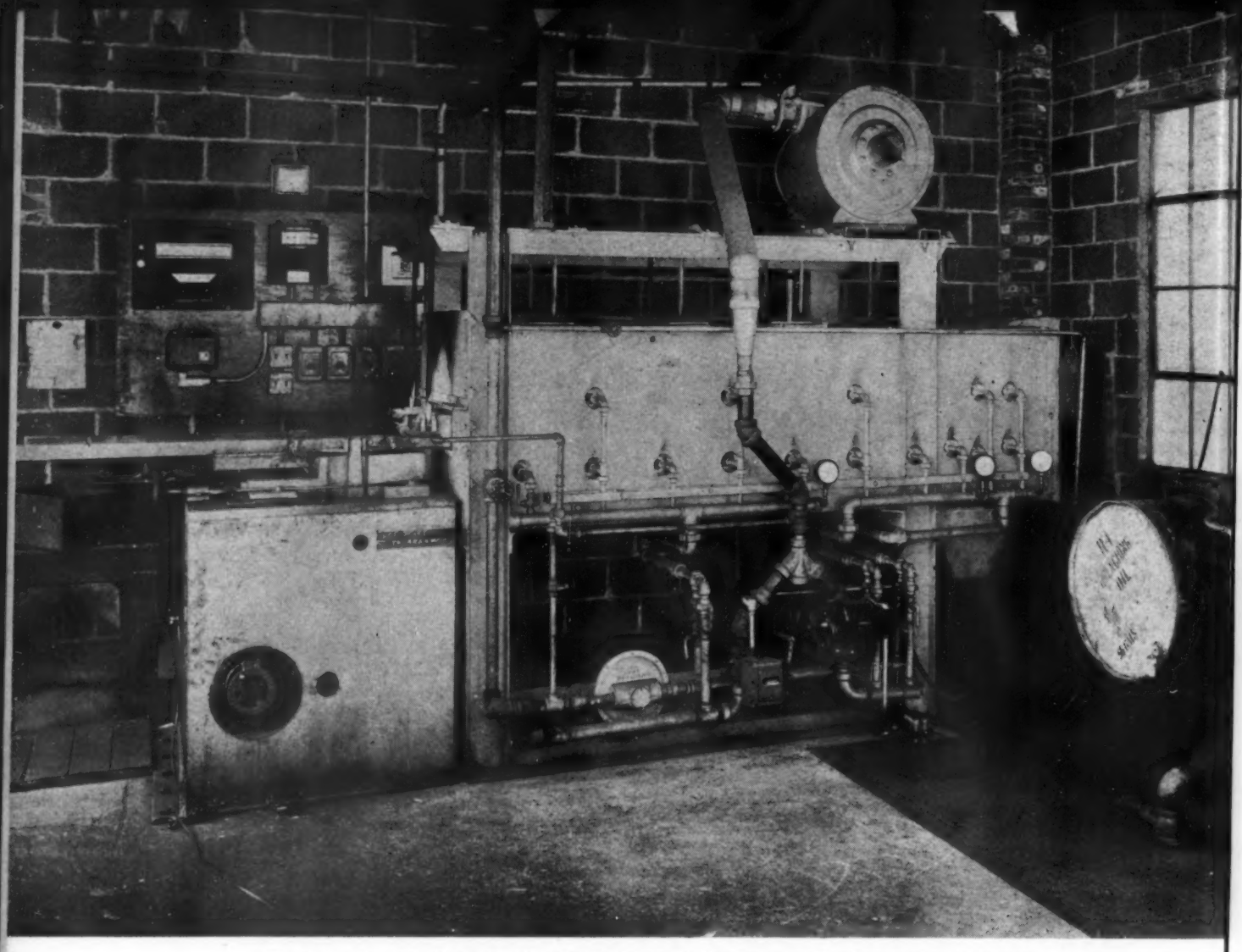


Reciprocating Heating Machine in the Plant of Well-Known Hardware Manufacturer

VERSATILE RECIPROCATING HEATING MACHINES SUITED TO WIDE VARIETY OF PROCESSES AND PRODUCTS

VERSATILITY is an outstanding characteristic of A.G.F. Reciprocating Heating Machines, which are suited to continuous clean hardening, annealing, normalizing, case-hardening by the patented Ni-Carb process, and many other types of work.

AMONG USERS are manufacturers of bearings, screws, lock washers, tools, wrenches, flat and coil springs, steel writing pens, and many others. Commercial heat treaters especially favor Reciprocating Heating Machines because these machines are able to handle the many varied and different jobs daily received in a general heat-treating shop.

THE RECIPROCATING MUFFLE advances work through the heat by its own momentum. The complete elimination of conveying mechanism from the heating chamber reduces maintenance problems and heat losses to a minimum. There is no traveling belt to be alternately heated and cooled—only work enters and leaves the machine.

MANUFACTURED IN FIVE SIZES, Reciprocating Heating Machines have capacities ranging from 10 to 1200 pounds of work per hour. Write for detailed literature on these machines and other types of heat-treating equipment.

VISIT A.G.F. AT THE METAL SHOW (American Gas Association Exhibit)

AMERICAN GAS FURNACE CO.

Elizabeth, New Jersey

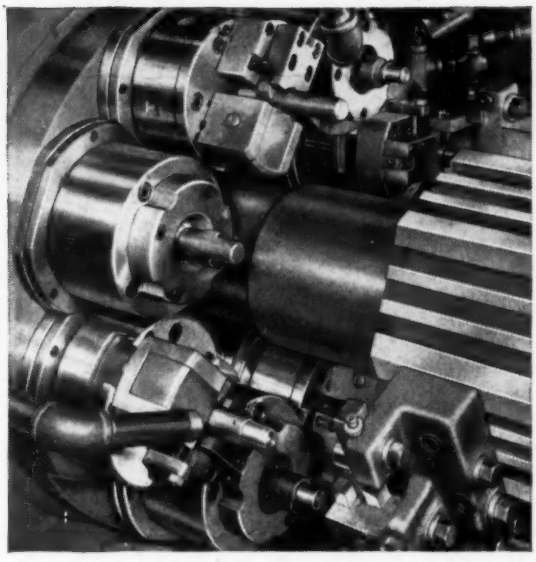
LEADERSHIP BASED ON ACCOMPLISHED FACTS

8 SPINDLE ACCURACY IN FULL Swing

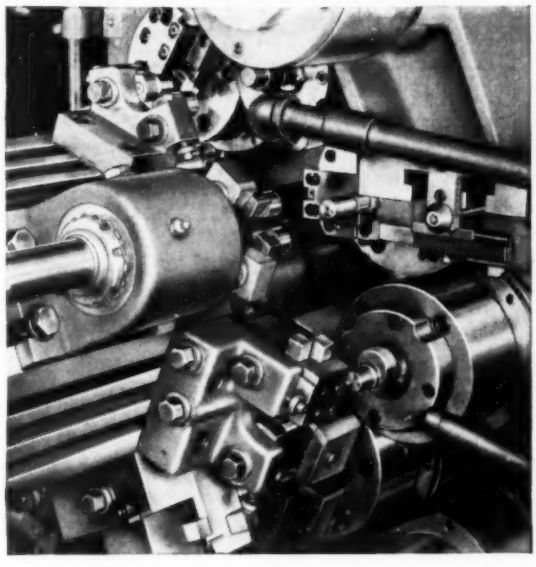
The piece shown above is a good illustration of the versatility of the New Britain Model 86 Eight Spindle Automatic Chucking Machine. By using double index on the Model 86, four spindles are used for one end of the crank shaft and the other four spindles used for the other end. Thus each time the machine indexes, it delivers a finished part.

Very important, too, is the maintenance of close diameter limits of both ends and holding the limits between the shoulders of the eccentric. This calls for a remarkable degree of precision in locating the shaft during the second operation . . . a severe test of the accuracy of the spindles and the carrier locating and locking mechanism.

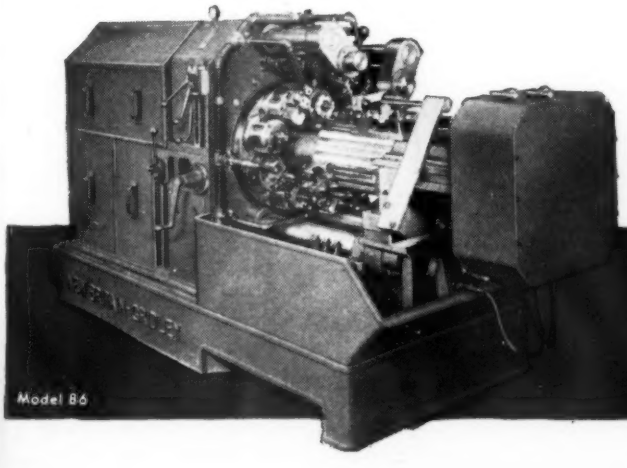
Production figures prove the ability of the machine to meet these testing requirements: The fifteen necessary operations are performed in 19 seconds. The gross production is 190 pieces per hour, with accuracy maintained well within the specified tolerances. Your work may or may not be similar to this particular job. One thing is sure . . . if it involves high production, and you want low cost per piece, the New Britain representative in your locality is the man to see.



FRONT VIEW—Entirely open end construction provides accessibility for simplified chucking, cutting tool and attachment setup.



REAR VIEW—Wide open end construction provides extra large chip...space accessibility from three sides and from above that permits excellent visibility and easy tool adjustment.



Model 86

NEW BRITAIN AUTOMATICS

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN, CONNECTICUT
NEW BRITAIN-GRIDLEY MACHINE DIVISION

M-01043

NOW THAT TIMKEN HAS DEVELOPED BETTER METHODS FOR MAKING TUBULAR PARTS . . .

—there is a big trend to seamless tubing!

One way to make a tubular part is to machine it, hole and all, from a round bar of alloy steel.

But a better way, nearly always, is to buy Timken Seamless Tubing and start your machining from there. You have no hole to drill so you hold scrap loss to a minimum. You reduce boring; get your finished part quicker and at a lower final cost. *Analysis for analysis, Timken Seamless Tubing machines as well as a bar. And quality of the finished part often is better.*

All sorts of ingenious methods to cut costs are being worked out by our Technical Staff. They are in a good position to give you valuable help because they draw upon wide experience gained in The Timken Roller Bearing factory, largest user of mechanical tubing in the world. From a job analysis of your operations, they can propose tubing which *we guarantee will make a satisfactory part when machined as recommended.*

If you use a tubular part in your product it would pay you well to consider making it from Timken Seamless Tubing. For information, write The Timken Roller Bearing Company, Canton 6, Ohio. *Timken Bearings, Timken Alloy Steels and Seamless Tubes, Timken Removable Rock Bits.*

TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
Fine Alloy
STEEL AND SEAMLESS TUBES

SMART EARLY BIRD: While rapid development of new machining techniques has won many manufacturers to seamless mechanical tubing, some are veteran users of many years standing.

Take the case of Company A————; users of Timken Tubing, cold drawn to 1.600 O.D. by 1.375 I.D. Since 1935, we've shipped them 690,000 feet.

Consider this comparison:

	Weight Per Foot	Machining Time
Bar Stock	6.835 lbs.	40 sec. per unit
Tubing	1.795 lbs.	10 sec. per unit

Total estimated savings in material amount to $19,680. Savings in machining time are estimated at $150,000.

We would be glad to cite you many other examples.

* *YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH*